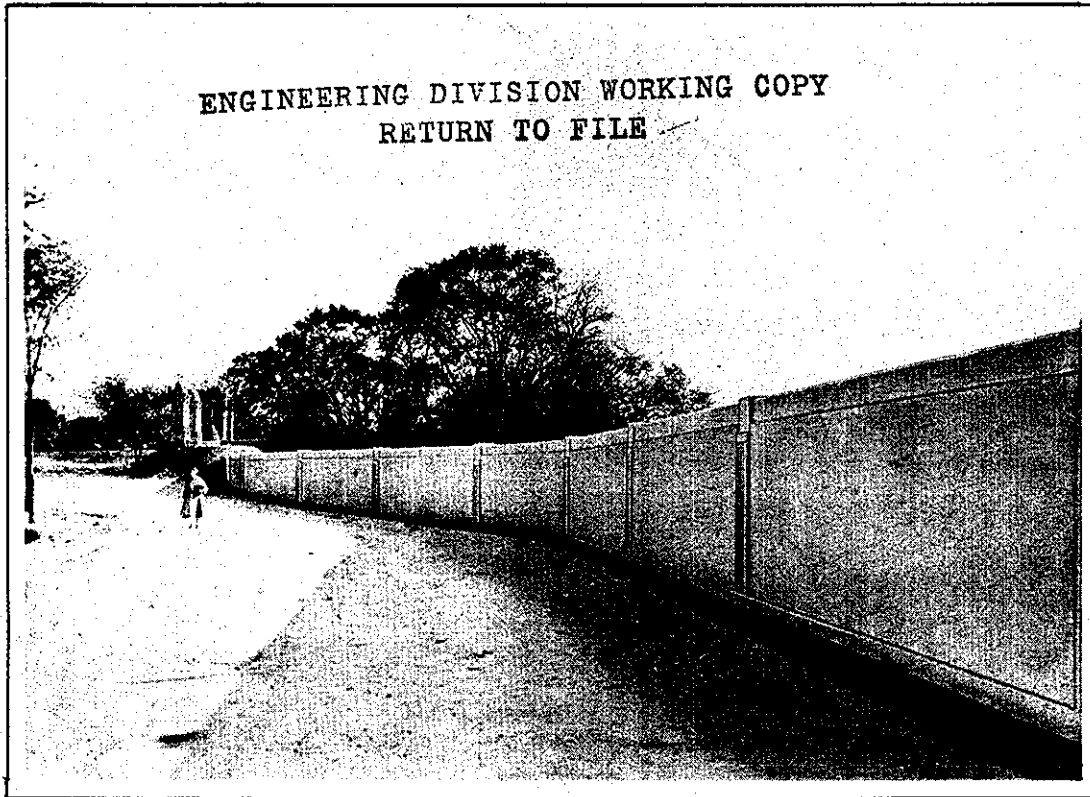


*Mechanical*

CONNECTICUT RIVER FLOOD CONTROL  
**OPERATION AND MAINTENANCE  
MANUAL**  
FOR  
FLOOD PROTECTION SYSTEM  
**SPRINGFIELD, MASS.**

ENGINEERING DIVISION WORKING COPY  
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FLOOD WALL - SPRINGFIELD, MASS.



WAR DEPARTMENT CORPS OF ENGINEERS U. S. ARMY  
U. S. ENGINEER OFFICE PROVIDENCE, R. I.

MARCH 1945

*28*

OPERATION AND MAINTENANCE MANUAL

FOR

FLOOD PROTECTION SYSTEM

AT

SPRINGFIELD, MASSACHUSETTS

U. S. ENGINEER OFFICE

PROVIDENCE, R. I.

MARCH 1945



SPRINGFIELD, MASS. — 20 MARCH 1936  
Dashed lines indicate flood protection system

# OPERATION AND MAINTENANCE MANUAL

## FLOOD PROTECTION SYSTEM

### SPRINGFIELD, MASSACHUSETTS

#### FOREWORD

The mere construction of an adequate system of dikes, walls, gates, and pumping plants is not permanent security against floods. To have complete assurance against floods it is necessary that the system, after being constructed, be carefully maintained at all times and be properly operated during flood periods. The necessity for proper maintenance is imperative in view of the fact that extensive damage or even the loss of life may be incurred through failure of a critical element of the system at flood time, caused by deterioration or damage that could have been avoided by proper maintenance. Faulty operation at flood time can cause considerable damage and may nullify the functioning of the entire protective system. Proper maintenance and correct operation of the flood protection system require that responsible local persons have a thorough understanding of the functions of the various units of the system and the best methods of maintaining and operating the system. Maintenance and operation shall be provided in strict accordance with the regulations prescribed by the Secretary of War and as amplified by this Manual.



OPERATION AND MAINTENANCE MANUAL

FLOOD PROTECTION SYSTEM

SPRINGFIELD, MASS.

TABLE OF CONTENTS

<u>Paragraph No.</u>	<u>Title</u>	<u>Page No.</u>
<u>SECTION I. INTRODUCTION</u>		
1-01	Authorization	1
1-02	Location	1
1-03	Dates of Construction	1
1-04	General Description	1
1-05	Protection Provided	1
1-06	Location Map	1
<u>SECTION II. LOCAL COOPERATION REQUIREMENTS</u>		
2-01	Flood Control Acts	2
2-02	Assurance of Local Cooperation	2
<u>SECTION III. GENERAL REGULATIONS</u>		
3-01	Purpose of this Manual	3
3-02	General Rules and Regulations	3
3-03	Maintenance	6
3-04	Operation	6
3-05	Reports	8
<u>SECTION IV. DIKES</u>		
4-01	Description	9
4-02	Maintenance	9
4-03	Operation	11
4-04	Emergency Repair Methods	12
<u>SECTION V. WALLS</u>		
5-01	Description	16
5-02	Maintenance	16
5-03	Operation	17
5-04	Emergency Repair Methods	17
<u>SECTION VI. DRAINAGE STRUCTURES</u>		
6-01	Description	19
6-02	Maintenance	21
6-03	Operation	22

TABLE OF CONTENTS (Cont'd)

<u>Paragraph No.</u>	<u>Title</u>	<u>Page No.</u>
	<u>SECTION VII. CLOSURE STRUCTURES</u>	
7-01	Description	23
7-02	Maintenance	24
7-03	Operation	24
	<u>SECTION VIII. PUMPING STATIONS</u>	
8-01	Description	27
8-02	Maintenance	27
8-03	Operation	28
	<u>SECTION IX. DRAWINGS AND SPECIFICATIONS</u>	
9-01	Drawings and Specifications	29

A P P E N D I C E S

APPENDIX "A"

REGULATIONS PRESCRIBED BY THE SECRETARY OF WAR

APPENDIX "B"

ASSURANCE OF LOCAL COOPERATION

APPENDIX "C"

INSPECTION REPORT FORMS

APPENDIX "D"

DRAWINGS AND BENCH MARKS

APPENDIX "E"

PHOTOGRAPHS

## SECTION I

### INTRODUCTION

1-01. AUTHORIZATION. - That portion of the flood protection facilities between the North End Bridge and the Boston & Albany Railroad Bridge was authorized under the provisions of the Emergency Relief Appropriation Act of June 29, 1937. All other portions of the existing flood protection works for the City were authorized by the Flood Control Act of June 28, 1938 (Public No. 761, 75th Congress).

1-02. LOCATION. - The project is located in the City of Springfield, Hampden County, Massachusetts, on the east bank of the Connecticut River from approximately River Mile 75 to River Mile 79.

1-03. DATES OF CONSTRUCTION. - Construction dates of the various sections were as follows: The section from the North End Bridge to the Boston & Albany Bridge was started December 6, 1937 and completed June 30, 1938; the section from the Chicopee Town Line to the North End Bridge was started December 13, 1938 and completed October 21, 1939; the section from Memorial Bridge to South End Bridge was started July 12, 1939 and completed May 3, 1940; the section from the Connecticut River up the Mill River to the Bay State Thread Company was started May 7, 1940 and completed May 21, 1941.

1-04. GENERAL DESCRIPTION. - The flood protection system consists of approximately 3,895 feet of earth dike, 11,164 feet of concrete flood wall, 1,600 feet of pressure conduit, and appurtenant drainage features to supplement the City system of disposal of interior drainage. There are six pumping stations in the system built by the City of Springfield. See Plates XXVII to XLIII of Appendix "D" for plans and profiles of the system.

1-05. PROTECTION PROVIDED. - The dikes and walls are designed to protect against a design flood, greater than any of record, reduced by the approved plan of twenty reservoirs. Only three of the twenty reservoirs have been built. The dike and wall grades are, at all points, equal to or above the maximum stage of the greatest flood of record, that of March 1936.

The section of wall built in Chicopee, from the Chicopee-Springfield town line north to high ground, protects portions of both cities. Operation and maintenance of this section of the protective works is primarily the responsibility of the City of Chicopee; however, the cities of Springfield and Chicopee should cooperate during flood periods in order to coordinate their activities to the best interest of both cities.

1-06. LOCATION MAP. - See Plate VI of Appendix "D" for location map.

## SECTION II

### LOCAL COOPERATION REQUIREMENTS

2-01. FLOOD CONTROL ACTS. - Section 3 of the Flood Control Act of June 22, 1936 (Public No. 738, 74th Congress) states:

"That hereafter no money appropriated under authority of this Act shall be expended on the construction of any project until States, political subdivisions thereof, or other responsible local agencies have given assurances satisfactory to the Secretary of War that they will (a) provide, without cost to the United States, all lands, easements, and rights-of-way necessary for the construction of the project, except as otherwise provided herein; (b) hold and save the United States free from damages due to the construction works; (c) maintain and operate all the works, after completion, in accordance with regulations prescribed by the Secretary of War."

The Flood Control Act of June 28, 1938 (Public No. 761, 75th Congress), which authorized the local protection works for Springfield, Massachusetts, states that the provisions of (a), (b), and (c) of Section 3 of the June 22, 1936 Act would still apply.

2-02. ASSURANCE OF LOCAL COOPERATION. - The following assurances were furnished by the City of Springfield:

a. For the section of the system from North End Bridge to the Boston & Albany Railroad Bridge, the City executed an assurance on December 27, 1937 and it was approved by the Secretary of War on January 15, 1938, ED 7402 (Conn. River)-383.

b. For the section of the system from the Chicopee Town Line to the North End Bridge, the City executed an assurance on January 5, 1939 and it was approved by the Secretary of War on February 6, 1939, ED 6500 (Conn. River - Springfield)-2.

c. For the section of the system from the Memorial Bridge to the South End Bridge, the City executed an assurance on April 21, 1939 and it was approved by the Secretary of War on May 16, 1939, ED 7402 (Conn. R. - Springfield)-10.

d. For the section of the system extending up the Mill River from the Connecticut River to the Bay State Thread Company, the City executed an assurance on March 22, 1940 and it was approved by the Secretary of War on April 19, 1940, ED 7402 (Conn. R. - Springfield)-30.

Copies of the assurances are included in Appendix "B" of this Manual.

## SECTION III

### GENERAL REGULATIONS

3-01. PURPOSE OF THIS MANUAL. - The purpose of this manual is to present detailed information to be used as a guide in complying with "Flood Control Regulations - Maintenance and Operation of Flood Control Works" as approved by the Acting Secretary of War on August 9, 1944, and published in the Federal Register on August 17, 1944, a copy of which is bound in the back of this volume as Appendix "A". In executing assurances of local cooperation for the Springfield project, the City has agreed to maintain and operate the completed works in accordance with those Regulations. The Regulations are intended to cover all local protection projects constructed by the Department throughout the United States, are general in nature, and obviously cannot give detailed instructions for the maintenance and operation of a specific project. The details set forth in this manual for maintenance and operation of the Springfield project are intended to supplement the Regulations to permit obtaining all the benefits and protection against floods for which the project was designed. Failure to maintain and operate the project as required by the Regulations and as detailed herein can cause severe property losses and loss of life and can result in an irreparable loss of confidence in the flood protection system by citizens who have invested their funds on the basis of the protection which it provides.

3-02. GENERAL RULES AND REGULATIONS. - a. The general rules of the regulations prescribed by the Secretary of War are in quotation marks below and are defined further by remarks under each quotation.

(1) "The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits."

(a) These requirements cannot be overstressed and the City authorities must make adequate provisions for funds, personnel, equipment, and materials to allow for the proper maintenance and operation of the flood protection works.

(2) "The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in

charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States."

(a) The committee should be composed of competent members, preferably men experienced in engineering or construction work of a nature similar to the flood protection works. The committee must be given broad authority to carry out its responsibilities.

(3) "A reserve supply of materials needed during a flood emergency shall be kept on hand at all times."

(a) Materials such as sand bags, lumber, nails, rope, cinders, etc., and tools such as picks, shovels, hammers, saws, crowbars, etc., should be obtained and held in reserve to meet any ordinary emergency that may occur during flood periods. Borrow pits for embankment materials should be secured and sources of where to obtain additional supplies of materials, tools and equipment should be well established in order that these articles can be obtained quickly in case of an emergency.

(4) "No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities."

(a) The grazing of cattle, disposal of rubbish, erection of fences, or barriers, wearing of foot paths or any form of trespassing on the project must be prohibited.

(5) "No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work."

(a) Any contemplated improvements or alterations as outlined above must be submitted to the U. S. Engineer Office, Providence, Rhode Island, and the approval of the District Engineer obtained prior to the City authorizing the work. All requests for approval shall be in writing and complete drawings, in duplicate, one set of which shall be in reproducible form, must be submitted along with a full description of the work intended. The City will be held responsible for obtaining prior approval from the U. S. Engineer Office, of any improvements or alterations proposed by themselves, private parties or any public parties. The City shall furnish the District Engineer as-built drawings, in duplicate, of the completed work.

(6) "It shall be the duty of the superintendent to submit a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works."

(a) See paragraph 3-05 of this manual for instructions on submitting reports.

(7) "The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works."

(a) The District Engineer or his representatives will make periodic inspections of the protective works to determine if the project is being properly maintained and operated by the City.

(8) "Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made."

(a) The City should maintain the facilities and keep them in good repair and not wait for the District Engineer to call such matters to their attention. The District Office will advise the City how to make any major repairs to the facilities.

(9) "Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods."

(a) The City should formulate plans and negotiate agreements with local organizations and companies, who are operating facilities connected with the protection works, to insure that their activities will be properly coordinated with the Superintendent's organization during flood periods.

(10) "The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations."



(a) The flood control committee should familiarize themselves with the contents of the manual. The superintendent should conduct classes to instruct his subordinates in the proper maintenance and operation of the flood protection facilities as outlined in the manual. The City authorities are encouraged to call on the U. S. Engineer District Office for any additional advice or instructions required by them in carrying out the City's obligations for maintaining and operating the flood protection facilities.

3-03. MAINTENANCE. - a. The word "maintenance", as used in this Manual, applies to the upkeep, repair, and care of the work constructed by the War Department and turned over to the City.

b. Proper maintenance is essential and must be rigidly enforced if the flood protection facilities are to function properly during flood periods. The salient points of maintenance are;

(1) The Superintendent must have an organization competent to perform the work.

(2) Responsible members of the organization must be familiar with every inch of the project.

(3) The component parts of the facilities and their function must be understood by the responsible members of the organization in order to maintain the facilities up to the standards of the original construction.

(4) Repairs to any of the project works shall be made with like or similar materials.

(5) Encroachments on, and abuse of the facilities must not be allowed.

(6) Install stop-logs and test gates, valves, etc., at stated intervals to discover difficulties, unworkable parts, and shortages that may affect the operation of the facilities at flood periods.

(7) Make regular inspections of all of the facilities in a thorough manner by actually walking the system and carefully looking for any signs of deterioration, need of repair or upkeep, making notes of the features that require attention; take necessary action to have the faults remedied and re-inspect the work to see if it is done to satisfactory standards.

c. Further instructions regarding maintenance of the major features of the work are described in other sections of this Manual.

3-04. OPERATION. - a. The word "operation" in this Manual applies to the manipulation and use of all the various features of the

protective facilities during flood periods of the river.

b. Efficient operation demands that the Superintendent and responsible members of his organization be familiar with every feature of the flood protection facilities and know when and how to take action to insure correct operation. The salient points of operation are:

(1) Know where stop-log structures, valves, and gates are located and when to close them.

(2) Know when to start pumping stations.

(3) Know where to look for possible signs of weakness or other indications or conditions which might endanger the proper functioning of the system.

(4) Have available adequate materials, equipment and labor to meet all contingencies.

(5) Know how, and take prompt action, to control any condition which endangers the facilities.

(6) Know how to get to every point of the works, even though it is dark and the customarily used routes are blocked.

(7) Make arrangements with the United States Weather Bureau Office, Brainard Field, Hartford, Connecticut (telephone No. Hartford 2-8116), to keep the City informed on flood predictions. The Weather Bureau Office at Hartford is the official agency for collecting precipitation data and the preparation of flood forecasts and is responsible for issuance of flood warnings. It receives, during impending flood periods, telephoned reports of precipitation and runoff every six hours from selected points in the Connecticut River Basin. From these data Connecticut River stage forecasts for critical locations between White River Junction, Vermont and Hartford, Connecticut are prepared.

(8) Know the municipal and local businessmen who are to assist in the flood fight. It will be to the City's advantage to negotiate agreements with private owners and companies to operate and maintain project features that are directly related to facilities and property of those parties. The City must remember, however, that the U. S. Engineer Department will look only to the City for maintenance and operation of the project since that is the body which executed assurances of local cooperation.

c. The detailed operation of the separate features of the facilities, such as flood walls, dikes, etc., are described in other sections of this Manual. Plate VI of Appendix "D" shows the river stages at which definite operations must be performed.

3-05. REPORTS. - a. The regulations prescribed by the Secretary of War call for reports to be submitted by the Superintendent to the District Engineer covering inspection, maintenance and operation. Inspections of the flood protective facilities shall be made immediately prior to flood seasons, immediately following floods, and otherwise at intervals not exceeding 90 days as required by the Regulations.

(1) Floods can occur in any month of the year. Spring is the season in which the majority of the floods have occurred. The three greatest floods of record occurred as follows; the highest occurred March 1936, the second highest September 1938, and the third highest November 1927.

b. To assist the Superintendent in making his inspections, a series of report forms for the individual features has been prepared. Samples of these reports are given in Appendix "C". The Superintendent will have additional copies printed for use in submitting his reports.

c. The semi-annual reports should be submitted, in triplicate, to the District Engineer each February and August. The reports will be submitted in letter form with copies of the inspection forms covering the inspections made during the period of the report. The report shall cover the following points.

(1) A description of the maintenance work performed in the preceding six months.

(2) The number and classification of men working on maintenance, regularly and intermittently.

(3) Description of any work performed by contract on the repair or improvement of the project.

(4) Describe what use or operation of the system was made during the period being reported.

(5) Suggestions relative to public cooperation and comments concerning public sentiment on the protection obtained, are considered pertinent and desirable data for inclusion in the report, but such data are not required.

## SECTION IV

### DIKES

4-01. DESCRIPTION. - The dikes for the protection of the City of Springfield are designed on sound engineering principles and are not mere piles of dirt from the handiest sources. They are constructed of a compacted earth core with a thick layer of dense impervious earth on the riverward side extending down into a cutoff trench to prevent the water from seeping through the dike, and a sandy pervious layer of earth on the landside of the dike to control the seepage of any water that might occur due to extended periods of high water. Both sides of the dike are covered with topsoil and a heavy growth of grass to prevent erosion. Pervious drains, constructed of graded rock or gravel and in some cases supplemented by open-joint pipe are located in the toe of the landward side of the dike except the section from North End Bridge to Clinton Street. These drains collect any seepage water passing through the dike and conduct it to the City system of drainage.

4-02. MAINTENANCE. - a. The following quotations from the regulations govern the maintenance of dikes.

"The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that;

(1) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(2) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(3) No seepage, saturated areas, or sand boils are occurring;

(4) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(5) Drains through the levees and gates on said drains are in good working condition;

(6) No revetment work or riprap has been displaced, washed out, or removed;

(7) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(8) Access roads to and on the levee are being properly maintained;

(9) Cattle guards and gates are in good condition;

(10) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(11) There is no unauthorized grazing or vehicular traffic on the levees;

(12) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent."

b. To help carry out the above quoted regulations the District Engineer recommends the following:

(1) Mow the grass when it reaches a height of about 8 inches cutting it back to a height of about 4 inches;

(2) When sections of the dike require reestablishment of turf, seeding operation should start at the earliest practicable date in the spring to secure the greatest possible protection against erosion. Areas requiring seeding should be dressed to fill gullies, and irregularities in the surface removed. The surface should then be raked or harrowed parallel to the contour of the dike (never up and down) to a depth of three-quarters of an inch. The following seed mixture was used in the original construction of the dike:

Perennial Rye Grass	11.6%
Orchard Grass	25.0%
Hard Fescue	6.7%
Kentucky Blue	10.0%

Sheep Fescue	10.0%
Timothy	11.7%
Perennial Red Clover	6.7%
White Clover	6.7%
Red Top	<u>11.6%</u>

100.0%

The above percentages are by weight. Reseeding should be at the rate of 45 pounds to the acre for reinforcing thin areas of grass and at the rate of 60 pounds to the acre for bare portions of the dike. Along with the seeding, each area should be given an application of a complete fertilizer at a rate to supply about 20 pounds of nitrogen per acre. The Massachusetts College of Agriculture at Amherst, Massachusetts or a recognized agronomist should be contacted for the purpose of analyzing the soil to determine if lime is needed and what fertilizer or seed mixture is best suited to the local conditions. After the seed is sown the surface should be lightly raked with iron rakes and all surfaces lightly rolled;

(3) Remove promptly from the dike any debris or drift deposits; such deposits are detrimental to the growth of grass and encourage the nesting of rats and burrowing animals who may create seepage paths through the dike by their burrowing actions;

(4) Where repairs to the dike are necessary use materials similar to those used in the original construction. Emergency repairs to the dike made during flood periods should be removed after the flood and the dike rebuilt to the original construction standards;

(5) Prohibit the establishment of paths over or on the dike since they destroy the sod and tend to cause the flow of rain water to concentrate at such points thereby eroding the dike.

4-03. OPERATION. - a. The following quotations from the regulations govern the operation of dikes.

"During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

- (1) There are no indications of slides or sloughs developing;
- (2) Wave wash or scouring action is not occurring;
- (3) No low reaches of levee exist which may be overtopped;
- (4) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section."

b. To help carry out the above quoted regulations the District Engineer recommends the following:

(1) Plan an organization for flood fighting prior to the flood, assigning foremen to the various sections of the project, with sufficient men to take care of any expected emergency. Be certain that the foremen have been instructed where and how to obtain materials they may need and that they understand their responsibility.

(2) Establish a good means of communications, instructing responsible members of the organization who and where to call for assistance and instructions and how to keep in communication in case the usual means are out of order.

(3) Determine the existence of any low reach of dike and make adequate provisions for men, materials, and equipment to raise the reach in case it is necessary.

(4) The Superintendent should personally make a final inspection just prior to the actual flood to be certain everything is in order, that his men are well posted and that the foremen know what they are supposed to do.

(5) Unauthorized traffic on the dikes should be stopped and patrolmen should be instructed to keep people off the dike unless they can show credentials authorizing their presence there.

4-Q4. EMERGENCY REPAIR METHODS. - a. The Superintendent or responsible members of his organization will use preventive measures to thwart any sign of deterioration and make emergency repairs to any endangered part of the structure. All such measures taken will be reported to the District Engineer immediately after the flood period.

(1) Sand boils. - A sand boil is a definite stream of seepage water issuing from the earth, usually found near the land-side toe of the dike and carrying sand or fine soil. All boils should be watched closely and if discharging sand or silt in more than minor quantities with the flow of the water, they are dangerous. If a sand boil shows signs of displacing material, it shall be watched closely to determine if the rate of flow and the quantity of material being displaced is increasing. If the water issuing from the boil is clear and no sign of increased flow is noticeable, no action is necessary other than providing means for draining the water away from the dike. If boils develop a force that is displacing material

quantities of sand or silt, they shall be immediately surrounded with a ring of sandbags to create a counter head of water to prevent a possible failure of the dike. A group of sand or silt-displacing boils should have a sub-dike built, of sandbags, around the entire nest of boils. A single boil can be controlled by a circle of sandbags around it. Single boils or groups of boils near the toe of the dike should have the sandbags on three sides tying the two ends of the sandbag enclosure into the dike with the dike thus acting as one side of the enclosure. It is important in building enclosures around sand boils, that they be built to sufficient height to stop only the displacement of material. A spillway must be provided on one side to control the runoff of water. Never attempt to stop completely the flow of water through the boil. Create just sufficient counter head to slow up the water until it runs clear without any material being carried out of the boil. The base width of the sandbag enclosure shall be at least 1-1/2 times the height. The enclosures shall be sufficiently large to avoid building it on a weakened foundation within the area disturbed by the boil and to permit sacking operations to keep ahead of the flow of water. The foundation for the sandbag enclosure shall be prepared by clearing the ground of all debris, loose sand, and other objectionable material. The sandbags should be filled only 2/3 full with sand, silt, or other suitable material. Place the first layer of bags perpendicular to the length of the wall with the unsewed ends facing the flow of water, lap the bags one on the other, place the second layer of sacks 90 degrees to the first layer or lengthwise of the wall, the third layer will be placed in the same direction as the first, and continue, alternating the direction of the layers until the desired height is obtained. In placing the sacks be sure to get the joints staggered and a sufficient lapping of the sacks. The bags must be tramped or mauled into place in order to get a compact wall. See Plate No. III of Appendix "D" for a sketch of the sandbag treatment of boils.

(2) Sloughs. - During high water stages seeping and sloughing conditions on the landward slopes of the dike may occur. A close vigil for such occurrences should be maintained, and if they develop, observe carefully the progress of the seepage up the back slope and the amount of material that is being carried by the water. If these seepage areas become soft or if the velocity of the water becomes great enough to cause, or probably cause, erosion or sloughing of the slope, a sandbag covering shall be placed on the seeping area, beginning well out from the toe and progressing up the slope. The covering should be laid shingle fashion with the unsewed ends faced up the dike slope and placed beneath the succeeding sacks, lapping the sacks about 1/3 on the preceding sacks. If more than one layer of sacks is required, stagger the joints. The covering should extend several feet beyond the saturated area. If the material is obtainable, the affected area should be first covered with small brush straw or similar permeable material to a depth of two to four inches before placing the sandbag cover. This will permit



the seep water to get away and also act as a filter to prevent the loss of earth from the dike. After placing the cover, the area must be observed closely and additional layers of sandbags are to be placed on the previous ones if the velocity of the flow becomes sufficient to displace appreciable material. Walking and working on the dike slope during high water conditions should be kept to the necessary minimum required, since these loads on the soft slopes will help to induce and aggravate sloughing. Do not maul the sandbags in place. See Plate IV of Appendix "D" for the treatment of sloughs.

(3) Wave wash. - Sections of the dike are likely to be damaged by wave action on broad reaches of water. During periods of high wind, high water, and ice, when waves and/or ice attack the dike, ample labor and material should be available, watchmen should look for washouts or scouring by actually wading along the submerged slope or by sounding the area with poles. If indications of washouts are discovered, sandbags should be placed immediately in the damaged area. Sandbags used for this purpose need be filled only half full but must be sewed or securely tied on the open end. The object is to obtain quickly the maximum coverage with only sufficient weight to hold the sacks in place. The sacks should be placed close together. The sacks should extend below the water surface at least two feet and further, if necessary. If the river is rising, and sacking for prevention of wave wash and attack by ice cannot be placed effectively in advance of the rising river, it is desirable to make a boom of logs, driftwood, or any available timber fastened together (sawmill style) and to string the boom along the dike slope, anchoring it about 15 feet out from the water's edge. This method is particularly effective against ice.

(4) Scouring. - During high water careful observations should be made of the riverside slopes of the dike at all localities where relatively high velocities are likely to occur, such as slopes not protected by riprap, dike angles, road crossing ramps, or traverses. If any indication of scour is observed, prompt action shall be taken to avoid further scouring by deflecting the current away from the dike by constructing deflection dikes, using available material such as brush, tree tops or lumber, or by sandbagging the slopes or dumping rock on the slope.

(5) Raising of dike. - See Appendix "D" for as-built profiles and a list of pertinent bench marks. In emergencies, low reaches of the dike, time and other conditions permitting, can be raised about three feet with reasonable safety. Methods most commonly used for this purpose are outlined in the following paragraphs and are recommended in the order listed;

(a) Sandbag topping. - The sacks commonly used are 100-pound grain or feed sacks. Smaller sacks, if made of fabric, can be used. One hundred pound grain sacks, when filled with a cubic foot of earth weighing approximately 100 pounds, will provide a unit

about 6 inches high, one foot wide and two feet long. The sacks need not be sewed or tied on the open ends; place the loose ends of sacks on top of preceding sacks. The front line of sandbags in the first layer should be laid stretcher-wise or along the dike, unsewed ends upstream. Other sacks in the first layer are laid crosswise the dike, unsewed ends to the riverside. The sacks in the second layer are laid crosswise to the dike alignment breaking the joints on the first layer, the third layer is similar to the first layer and succeeding layers are so alternated until the desired height is reached. The sandbags should be well tramped or mauled in place. Exposed ends of sandbags must be tucked underneath the bags. A crew of 50 men should fill, carry and place approximately 1500 sacks per eight hour day, all hand labor, when the source of material is within 150 feet of the point of placement. Production will depend on conditions at the site. Plate I of Appendix "D" shows this method of construction.

(b) Lumber and sandbag topping. - Raising of low reaches of dike grade by lumber and sandbag topping is a very good method. The chief objection is the time element of installation. In erecting this type of topping, a line of levels should be run and grade stakes set in advance. Two by four or two by six stakes should then be driven well into the ground on the riverside of the dike crown on six-foot centers and one-inch thick boards nailed on the landside of the stakes. Back up this wood wall with sandbags, laying the row next to the boards in the first layer lengthwise the dike, other sacks in this layer crosswise the dike. This type wall backed by one tier of sacks will hold out about one foot of water. If additional height is required, build the planking up and raise the sandbag backing, placing layers of sandbags as outlined in the preceding paragraph. The stakes should be driven at least 3 feet into the ground leaving three feet out of the ground; in extreme conditions this type construction, if properly backed by sandbags, will hold out three feet of water. See Plate II of Appendix "D" for a sketch of this type of construction. Well tamped impervious earth may be substituted for the sandbags if deemed to be more advantageous.

(c) Cut crown topping is the method whereby the material in the dike on the landward side of the center line crown is excavated and used to build up the riverside of the dike crown. The cut should never exceed one foot nor be nearer the riverside of the dike than the center line of the crown. This is a very hazardous undertaking and should not be resorted to except in the greatest extremity and only after permission of the highest City authorities has been obtained.

(6) Toe drains. - Frequent examinations should be made of the toe drain outlets, and if muddy water appears and increases in intensity its source should be immediately determined and the source isolated from the toe drains and controlled by building a sub-dike around it to create just sufficient counterhead to stop the displacement of material.

## SECTION V

### WALLS

5-01. DESCRIPTION. - The walls are of the reinforced concrete cantilever type, consisting of a vertical wall, or stem, on a base with a key and a steel sheet piling cutoff wall. At the toe, on the landside of the wall base, porous drains were constructed to collect any seepage water and are connected to the city drainage system. The walls were then backfilled up to natural ground elevation to provide surface drainage.

5-02. MAINTENANCE. - a. The following quotations from the regulations govern the maintenance of dikes.

"Periodic inspections shall be made by the Superintendent to be certain that;

- (1) No seepage, saturated areas, or sand boils are occurring;
- (2) No undue settlement has occurred which affects the stability of the wall or its water-tightness;
- (3) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;
- (4) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water-tightness;
- (5) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;
- (6) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;
- (7) No bank caving conditions exist riverward of the wall which might endanger its stability;
- (8) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary

by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice."

b. To help carry out the above quoted regulations the District Engineer recommends the following:

(1) Check the expansion joints during the inspections as they will readily show any signs of settlement or movement that might occur to the walls.

(2) When the expansion joint material has deteriorated to the point where it no longer serves its purpose the loose material should be cleaned out, care being exercised not to injure the copper seal, and the joint poured full with asphalt.

(3) Keep weeds, grass and brush cut down to eliminate fire hazards that might injure the walls.

5-03. OPERATION. - a. The following quotations from the regulations govern the operation of walls.

"Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall."

b. The recommendations made in paragraph 4-03 b for dikes apply equally as well to the operation of the walls.

5-04. EMERGENCY REPAIR METHODS. - a. The Superintendent or responsible members of his organization shall take immediate action to correct any condition which endangers the stability of the wall. All such measures taken will be reported to the District Engineer immediately after the flood period.

(1) Sand boils. - See Section IV, Paragraph 4-04 a (1), for a description and treatment of sand boils.

(2) Toe drains. - Frequent examination should be made of the toe drain outlets and if muddy water appears and increases in intensity its source should be immediately determined and the source isolated from the toe drain and controlled by building a sub-dike around it to create just sufficient counterhead to stop the displacement of material.

(3) Monolith joints. - If appreciable leakage occurs at vertical monolith joints, it can be controlled by dumping cinders,

sawdust, or other such material on the riverside of the wall. The dumped material will be carried into the joint by the water and plug the leak.

(4) Raising grade of wall. - In the event there is danger of the walls being overtopped by the flood, they can be raised, with reasonable safety, to three feet above their present grade. One tier of sandbags placed with the unsewed ends upstream and beneath the forward bag will add a height of approximately six inches to the wall. If the wall grades are to be raised beyond six inches it can be best accomplished by erecting a wooden extension such as shown on Plate V of Appendix "D".

## SECTION VI

### DRAINAGE STRUCTURES

6-01. DESCRIPTION. - a. The drainage structures consist of sewer and drain pipes that existed prior to the construction of the flood protection facilities and drainage structures built as part of the facilities as follows:

(1) The Mill River conduit is a reinforced concrete structure having a cross section the shape of a horseshoe, the major inside axis being fifteen feet, six inches, and the minor inside axis being thirteen feet, nine inches. The impounding basin above the conduit entrance is formed of cantilever type reinforced concrete walls tying into the Bay State Thread Company's dam on the north side and into the high rock bank on the south side of the river. The lower end of the conduit emerges into an open box culvert used as a snow dump, which is a reinforced concrete structure having an open box cross section. The snow dump on the downstream end is tied into the New Haven and Hartford Railroad arch bridge with a transition section and the bridge is lined with reinforced concrete, to prevent erosion.

(a) Drainage lines were installed on both sides of the conduit to connect up old drain lines and sewers that had previously emptied directly into Mill River. These new drains were connected to the City's syphon sewer that passes under the conduit at Columbus Avenue.

(b) A low water outlet from the syphon gate chamber on the south side of the conduit was connected to the conduit at Station 10+47.8.

(c) A pressure sewer that formerly discharged into Mill River was connected to the north side of the conduit at Station 5+16.5.

(d) A 12-inch cast iron drain with gate valve was placed through the impounding basin wall at Station 1+78 to take care of drainage from the Bay State Thread Company.

(e) The two draft tubes from the Bay State Thread Company's turbine, pass through the impounding basin wall; these openings can be closed with stop-logs. A 5' x 6' sluice gate with manually operated hoist was installed in the headrace structure. See Plates XXXIX through XLIII for location of the conduit and the above-mentioned sewers and drains.

(2) A 12-inch cast iron drain with valve was placed under Wall A at the foot of Bliss Street Station 17+02. See Plates VII and XXXV for the location of this drain.

b. All drains and sewers have facilities to prevent backwater from flooding the city. The location of drains and sewers passing through or under the flood protection facilities are shown on the following list.

SECTION FROM NORTH END BRIDGE TO CHICOPEE TOWN LINE:

<u>Station Location</u>	<u>Description</u>
12+00	Washburn Street Sewer
15+0 $\frac{1}{4}$	30" water main
15+35	30" water main
38+7 $\frac{1}{4}$	Rowland Avenue sewers
47+63	Laurel Street sewer
56+75	Wason Avenue sewer

SECTION SOUTH OF NORTH END BRIDGE:

<u>Station Location</u>	<u>Description</u>
133+00	Clinton Street sewer
3+1 $\frac{1}{4}$	Water drain
9+2 $\frac{1}{4}$	Cypress Street sewer

SECTION FROM MEMORIAL BRIDGE TO SOUTH END BRIDGE:

Wall A

<u>Station Location</u>	<u>Description</u>
6+57	16" suction line for Gas Co.
6+60	8" sewer line for Gas Co.
7+91	6" drain from U.E.L. Co. Bldg.
8+95	20" " " " " "
9+3 $\frac{1}{4}$	Suction line " " "
9+65	14" drain from " " "
17+02	12" drain under wall
21+60	Union Street sewers

Wall B

<u>Station Location</u>	<u>Description</u>
6+72.8	York Street sewer
8+57	48" sewer
10+74.7	48" sewer

SECTION FOR MILL RIVER CONDUIT:

<u>Station Location</u>	<u>Description</u>
0+91.6	Draft tube from Bay State Thread Co.
1+04.6	" " " " " " "
1+78	12" drain " " " " "
5+16.5	Sewer connected to conduit
10+47.8	Low water outlet from Columbus Avenue siphon.

6-02. MAINTENANCE. - a. The following quotations from the regulations govern the maintenance of drainage structures:

"Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop-log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(1) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(2) Inlet and outlet channels are open;

(3) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(4) Erosion is not occurring adjacent to the structure which might endanger its water-tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections."

b. To help carry out the above quoted regulations the District Engineer recommends the following:

(1) Place chains across the entrance to Mill River conduit, and fasten them to the eyebolts that were installed in the walls and columns; this will prevent large floating objects from entering the conduit.

(2) Inspect the construction joints of the conduit for indications of settlement.



(3) Keep the pressure manhole covers securely fastened.

(4) Make an agreement with the Bay State Thread Company for the maintenance and operation of the sluice gate in their headrace structure and the draft tubes from their turbine.

(5) Place markers at each pipe that passes under the dikes and walls so they can be readily found during flood periods.

6-03. OPERATION. - a. The following quotations from the regulations govern the operation of drainage structures.

"Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition."

b. To help carry out the above quoted regulations the District Engineer recommends the following:

(1) Whenever a flood is imminent close the sluice gate in the Bay State Thread Company's headrace structure as soon as the mill stops using water power.

(2) In the event of a threatened blowout to the ground surface by a sewer, during flood periods, it can usually be controlled by loading the area with sandbags. If such a blowout should occur control it by building a subdike of sandbags around the blowout.

c. For the sequence of operation of the drainage structures when a flood is imminent, see Plate VI of Appendix "D".

## SECTION VII

### CLOSURE STRUCTURES

7-01. DESCRIPTION. - The closure structures are of two types, the sandbag type, and the stop-log type. The purpose of the closures is to permit passage of traffic through the wall during non-flood periods. The sandbag closure is located just south of Elm Street and permits the mainline tracks of the New York, New Haven and Hartford Railroad to pass through the wall. This closure has a span of 60 feet, 4 inches. It consists of a steel sheet pile cut-off wall with a concrete cap, the top of cap being four inches below base of rail, or elevation 63.67. The elevation of adjacent walls is 66.40. To make this closure it will require a sandbag wall 2 feet, 9 inches high, or about six sandbags in height. The remaining closures are of the stop-log type. They consist of openings in the wall with a sill or footing at the bottom of the opening and grooves in the ends of the adjacent walls for receiving the ends of the timber beams which span the opening when the closure is made. The two that have railroad sidings through them require sandbags at the bottom of the opening to chink around the rails and cross ties. The stop-log structures are located as follows: (See Plate VI of Appendix "D".)

a. At the door in the north end of the United Electric Light Company plant. This opening has a clear span of 10 feet, and a sill elevation of 59.3.

b. Just south of United Electric Light plant, at the foot of Bliss Street, Station 12+49, Wall A. This opening has a clear span of 12 feet and a sill elevation 58.8.

c. Just north of the foot of Union Street at Station 18+34, Wall A. This opening has a clear span of 12 feet and a sill elevation of 62.7.

d. Approximately 400 feet south of Mill River at west end railroad driveway to South Street railroad yard, Station 3+26.25, Wall D. This opening has a clear span of 18 feet and a sill elevation of 58.2.

e. Just north of the South End Bridge at the junction of Wall D and the earth dike, Station 16+66.83, Wall D. This opening has a clear span of 18 feet and a sill elevation of 60.5.

f. At the discharge end of the two draft tubes from the turbine at the Bay State Thread Company. These openings permit the draft tubes to discharge the water from the turbine through the wall. The openings are rectangular with a span of 7 feet and a height of 2-1/2 feet. The elevation of the bottom of the openings

is 56.0. These openings should be closed at flood time to prevent a flood back of the wall due to possible failure of the draft tubes.

7-02. MAINTENANCE. - a. The following quotations from the regulations govern the maintenance of closure structures.

"Closure structures for traffic openings shall be inspected by the Superintendent every 90 days to be certain that:

- (1) No parts are missing;
- (2) Metal parts are adequately covered with paint;
- (3) All movable parts are in satisfactory working order;
- (4) Proper closure can be made promptly when necessary;
- (5) Sufficient materials are on hand for the erection of sandbag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sandbag closure is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately."

b. To help carry out the above quoted regulations the District Engineer recommends the following:

- (1) Store the stop-log timbers in the city yard located on Columbus Avenue just south of Mill Street. The timbers should be kept in a shed to protect them from the weather and stacked with strips of lumber between them at the end, quarter and midpoints. Keep the timbers for each stop-log structure in separate piles and place a sign on the pile to identify which stop-log structure the timbers belong to.

7-03. OPERATION. - a. The following quotations from the regulations govern the operation of closure structures.

"Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method

of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them."

b. To help carry out the above quoted regulations the District Engineer recommends the following:

(1) During flood periods the erection of closure structures should be started in sufficient time to insure the complete closing of the gap before water reaches the sill of the closure. The location of the closures is described in paragraph 7-01 and indicated on Plate VI of Appendix "D", which also shows the gage reading (Memorial Bridge gage) at which the openings should be closed to prevent flooding of the area back of the opening. Public and private parties whose passage through the closure structures is affected by the stopping of the gap should be notified of the intended closing in sufficient time to permit them to evacuate unprotected areas. Determination of the time at which any closure erection should be started must be based upon the rate of river rise and time required for installation. Rate of rise of the river may be expected to range up to 0.8 foot per hour during the period required to effect the closure (see paragraph 3-04 b (7) for advice on river predictions). Plate XXVI of Appendix "D" shows the erection of stop-log structure No. 3, which is similar to the other stop-log structures for the City of Springfield. The following table gives the estimated time for installing the closures by trained crews equipped with the necessary tools, parts, and material.

<u>Movable Closure</u>	<u>Size of Crew</u>	<u>Time Required</u>
N.Y., N.H. & H. RR Foot Elm Street	50 men	3 hours
Door North End United Electric Light Bldg.	3 men	1-1/2 hours
Stop-log No. 1, Foot Bliss Street	3 men	1-1/2 hours
Stop-log No. 2, Foot Union Street	3 men	1 hour
Bulkhead Door York Street Jail	2 men	1 hour
Stop-log No. 3, South of Mill River	4 men	2 hours
Stop-log No. 4, North-South End Bridge	4 men	2 hours
Stop-log Draft Tubes Bay State Thread Co.	2 men	1 hour

(2) After the stop-log timbers are in place canvas or sisal craft paper should be tacked over the river side of the timbers to prevent undue leakage of water through the cracks between the timbers. The top timbers in the closure should be wedged in place to prevent their tendency to float. Ample time should be allowed to erect the closures and due allowance should be made for the fact that the necessity for the erection of three closures will occur at equal

river stages. It should be recognized that delays in operation may be occasioned by inexperienced help and other contingencies. After erection, when the rising water has reached the closure, some leakage may occur. Excessive leakage can be prevented by the use of sandbags, cinders, sawdust, or other sealing materials, sufficient stocks of which should be kept on hand where they will be immediately available during the emergency. The closure structures should be inspected frequently to ascertain if undue leakage is occurring.

(3) Care should be exercised to avoid removal of stop-logs during a temporary recession of flood waters which might be followed immediately by a second crest. When all danger from the flood has passed remove the timbers, clean them, repair any damaged ones and store them in their proper place.

## SECTION VIII

### PUMPING STATIONS

8-01. DESCRIPTION. - There are six pumping stations in the system of flood protection for the City of Springfield. The stations are equipped with major pumping units, the number varying from 3 in the smaller stations to 4 in the larger stations. These stations were constructed by the City of Springfield.

The York Street Station is operated continuously for the purpose of pumping sewerage under the river to the sewerage treatment plant located on Bondi Island. The experienced crew of men who constantly operate the York Street Station form a nucleus of personnel for the operation of the flood control pumping stations during flood periods. These stations are considered adequate to handle the sewerage, storm waters, and any infiltration expected to occur during flood periods.

8-02. MAINTENANCE. - a. The pumping stations are important facilities which function as a part of and affect the efficient functioning of the flood protection system and therefore are subject to the regulations prescribed by the Secretary of War. The following quotations from the regulations govern the maintenance of pumping stations:

"Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring

removal of equipment from the plant shall be made during off-flood seasons insofar as practicable."

8-03. OPERATION. - a. The following quotations from the regulations govern the operation of pumping stations;

"Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturer's instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood."

b. Plate VI of Appendix "D" gives the river stage at which pumping stations are to be placed in operation.

SECTION IX

DRAWINGS AND SPECIFICATIONS

9-01. DRAWINGS AND SPECIFICATIONS. - Complete sets of contract plans and specifications were presented to the City of Springfield when the various projects were completed, turned over to and accepted by the City. The various projects were:

North End Bridge to Boston and Albany Railroad Bridge  
Initial Fiscal Year 1939 Unit (Item S-1)  
Memorial Bridge to South End Bridge (Item S-2)  
Mill River Conduit (Item S-3)  
North End Bridge to Chicopee Town Line (Item S-4)



APPENDIX "A"

	PAGE
REGULATIONS PRESCRIBED BY THE SECRETARY OF WAR	A-1

## TITLE 33—NAVIGATION AND NAVIGABLE WATERS

### Chapter II—Corps of Engineers, War Department

#### PART 208—FLOOD CONTROL REGULATIONS MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1936, as amended and supplemented (49 Stat. 1571; 50 Stat. 877; and 55 Stat. 638; 33 U. S. C. 701c; 701c-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

§ 208.10 *Local flood protection works; maintenance and operation of structures and facilities*—(a) *General*. (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) *Levees*—(1) *Maintenance*. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of

the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) *Operation*. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) *Flood walls*—(1) *Maintenance*. Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) *Operation*. Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) *Drainage structures*—(1) *Maintenance*. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) *Closure structures.*—(1) *Maintenance.* Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order,

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given

in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants.*—(1) *Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways.*—(1) *Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities.*—(1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Regs. 9 August 1944, CE SPEWF)

[SEAL]

J. A. ULIO,  
Major General,  
The Adjutant General.

[F. R. Doc. 44-12285; Filed, August 16, 1944;  
9:44 a.m.]

## APPENDIX "B"

	PAGE
ASSURANCE OF LOCAL COOPERATION	
North End Bridge to Chicopee Town Line	B-1
North End Bridge to Boston & Albany Bridge	B-5
Memorial Bridge to South End Bridge	B-10
Mill River Conduit	B-12

U. S. ENGINEER OFFICE  
PROVIDENCE, R.I.  
F.C. 9/12  
JAN 7 - 1939

Mayor's Office  
ROGER L. PUTNAM  
Mayor

City of  
SPRINGFIELD  
Massachusetts

January 5, 1939.

Lieut. Col. J. S. Bragdon,  
District Engineer,  
United States Engineer Office,  
Providence, R. I.

My Dear Col. Bragdon:

Pursuant to the request of your staff, and in accordance with an order approved by the Board of Aldermen on December 12, 1938, by the common council on December 28, 1938, and approved by the mayor on December 28, 1938, and in compliance with the requirements of Section 3 of the Flood Control Act of 1936, the Secretary of War of the United States is hereby assured by the mayor of the City of Springfield that the City of Springfield will comply with the provisions of Section 3 of the Flood Control Act of 1936 in connection with the works shown on a plan entitled "Connecticut River Flood Control, SPRINGFIELD DIKE, Initial Fiscal Year, 1939 Unit, Project Location and Index, Springfield, Mass., Connecticut River, Massachusetts, Scale 1" = 1500 ft. Sheet No. 1, U. S. Engineer Office, Providence, R I Oct 1938".

The mayor of Springfield, in accordance with said order of December 28, 1938, does hereby grant to the Secretary of War, all rights necessary for the duly authorized employees or agents of the United States to enter upon and construct the strengthening of Dikework protection from the flood or freshet flows of the Connecticut River, extending along Riverside Road from West Street to the line between Springfield and Chicopee.

All of the land involved is, and has been, owned by the City of Springfield for many years, either for the purpose of a playground or as a public street, and no other title or interest is involved.

Very truly yours,

/s/ Roger L. Putnam

Mayor

CITY OF SPRINGFIELD

In Board of Aldermen, December 12, 1938

ORDERED, if the Common Council concur,

That the existing dike work protection from flood or freshet flows of the Connecticut River extending along Riverside Road, be strengthened by the improving and raising a height of two (2) feet, the existing earth dike work from a point 75 feet northerly of West Street to a point 500 feet northerly of West Street, and also by the construction of a reinforced concrete retaining wall with steel sheet piling extending from the base of said retaining wall down to impervious soil material, from said point 500 feet northerly of West Street northerly to the line between Springfield and Chicopee, as recommended by the Engineers of the War Department of United States, and that granite curbing be laid as a protection of said retaining wall, said curbing to be laid approximately three (3) feet easterly of the face of said wall, and

That the existing catchbasins now located at the edge of the existing dike work be reconstructed at the said protective curbing, and

That upon the strengthening of said dike work as hereintofore provided, the portion of Riverside Road devoted to vehicular traffic hereinafter called the roadway, from a point 532 feet northerly of West Street, northerly to the line between Springfield and Chicopee, be changed to a width of 28 feet, with the easterly edge of said roadway located as follows:

At said point 532 feet northerly of West Street at 13 feet distant westerly of the easterly line of Riverside Road;

From said point 532 feet northerly of West Street to a point 676 feet northerly of West Street, at a distance westerly of the easterly line of Riverside Road uniformly decreasing from 13 feet to six (6) feet;

From said point 676 feet northerly of West Street to the line between Springfield and Chicopee, at six (6) feet distant westerly of the easterly line of Riverside Road;

And that the said roadway be repaired and reconstructed in the location described above;

And that the Superintendent of Streets and Engineering under the supervision and direction of the Board of Supervisors, be and hereby is authorized to cause said work to be constructed;

And that the cost of the work be taken from the appropriation made for the purpose; and

WHEREAS, the work of strengthening the dikework hereinbefore mentioned, is to be performed by the United States of America and in accordance with plans entitled "Connecticut River Flood Control, SPRINGFIELD DIKE, Initial Fiscal Year, 1939 Unit, Project Location and Index, Springfield, Mass., Connecticut River, Massachusetts, Scale 1" - 1500 ft. Sheet No. 1, U. S. Engineer Office, Providence, R. I. Oct 1938" which are on file in the United States Engineer Office, Providence, Rhode Island. And in accordance with the established policy of the Corps of Engineers, the City of Springfield, will furnish necessary borrow pits with rights of entry thereto, and

WHEREAS, by Section 3 of the Flood Control Act approved June 22, 1936, known as the Flood Control Act of 1936, no money appropriated under authority of said act shall be expended on the construction of any project until states, political subdivisions thereof, or other responsible local agencies have given assurances to the Secretary of War that they will (a) provide without cost to the United States, all lands, easements, and rights-of-way necessary for the construction of the project; (b) hold and save the United States free from damages due to the construction works; (c) maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of War; and

WHEREAS, by the Flood Control Act approved June 28, 1938, local flood protection works were authorized to be constructed in Springfield, Massachusetts, along the easterly bank of the Connecticut River, from West Street to the line between Springfield and Chicopee, which said works are subject to the provisions of Section 3 of the Flood Control Act of 1936; and

WHEREAS, an allotment of funds has been made for the prosecution of said works of strengthening dikework,

NOW, THEREFORE, it is hereby ordered that all lands, easements and rights-of-way necessary for the construction of this work hereinbefore set forth and described, be provided without cost to the United States of America; and that the United States of America shall be holden and saved free from damages due to the construction works; and that the City of Springfield shall maintain and operate the works after the completion thereof by the United States of America, in accordance with regulations prescribed by the Secretary of War; and that the City of Springfield shall furnish necessary borrow pits with rights of entry thereto.

And it is further ordered that the Mayor be and hereby is authorized to grant to the Secretary of War the rights and assurances necessary for the duly authorized employees or agents of the United States to enter upon and construct the aforesaid strengthening of Dikework protection from the flood or freshet flows of the Connecticut River, extending along Riverside Road from West Street to the line between Springfield and Chicopee.

And it is further ordered that upon the completion of the above mentioned work of strengthening said dikework, the Mayor be and hereby is authorized to accept said work in the name and on behalf of the City of Springfield.

A true copy of an order passed by the Board of Aldermen, December 12, 1938, by the Common Council December 28, 1938 and approved by the Mayor December 28, 1938.

Attest:

/s/ Clifford F. Smith

City Clerk



ASSURANCES BY THE CITY OF  
SPRINGFIELD, MASSACHUSETTS

WHEREAS, funds have been allotted under the Emergency Relief Appropriation Act of 1937, dated June 29, 1937 and approved by the President of the United States on November 19, 1937, for the construction of dike works for flood control between the North End Bridge and the Boston and Albany Bridge in the City of Springfield, Massachusetts, and

WHEREAS, the United States of America, through the Corps of Engineers of the War Department, having jurisdiction of construction of said flood control projects, and in accordance with the policy of the Federal Government that no money shall be expended on the construction of any project until States, political sub-divisions thereof, or other responsible local agencies have given assurances satisfactory to the Secretary of War that they will (a) provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the project; (b) hold and save the United States free from damages due to the construction works; (c) maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of War; and

WHEREAS, by chapter 94 of the Acts of 1852 of the Commonwealth of Massachusetts establishing the City of Springfield as a municipal corporation, and acts in amendment thereof and in addition thereto, and also under the provisions of chapter 117 of the Acts of 1937 of said Commonwealth, and also under the provisions of General Laws of Massachusetts chapter 40 sections 1, 4 and 5, the city council of the City of Springfield has the authority to authorize the acceptance

of the offer of the United States of America to construct certain works of improvement for flood protection in the City of Springfield, Massachusetts, and

By order of the city council of the City of Springfield, Massachusetts, approved by the mayor December 27, 1937, a certified copy of which, with full endorsements thereon, is attached hereto and made a part of this agreement, Henry Martens, Mayor of the City of Springfield, was authorized in the name and behalf of the City of Springfield to execute and deliver to the United States of America a written agreement assuring to the United States of America that the City of Springfield will perform what is required by the Secretary of War.

NOW, THEREFORE, in order to comply with the established policy of the Federal Government pertaining to the construction of flood control projects and in consideration of the construction by the United States of America, and of the benefits to accrue from the work or improvement, the City of Springfield hereby assures the Secretary of War as follows:-

(a) That the City of Springfield will furnish, without cost to the United States, all lands, easements and rights-of-way, necessary for the construction of dikes along the Connecticut River for flood protection of the City of Springfield from the North End Bridge to the Boston and Albany railroad bridge. The lands, easements and rights-of-way which the City of Springfield shall furnish shall include those needed for erection of said dikes and for borrow pits. Maps showing the lands, easements and rights-of-way needed in the

prosecution of the work will be obtained by the City of Springfield for the United States. Detailed property surveys and title searches necessary to acquire the land or interests therein will be performed by the City of Springfield.

(b) That the City of Springfield will save harmless and protect the United States of America, its officers and agents, from any and all claims for damages and from all liabilities, but excluding any claim or claims of an employee, contractor or subcontractor, servant, agent, or officer of the United States for personal injuries received in connection with said improvement work, and excluding any claim or claims of a person, or persons, for injuries or damages suffered by reason of the negligence of any employee, contractor or subcontractor, servant, agent, or officer of the United States engaged in said project.

(c) That the City of Springfield will hold and save the United States of America free from damages due to the construction works.

(d) That the City of Springfield will maintain and operate all works after completion in accordance with the regulations prescribed by the Secretary of War.

IN WITNESS WHEREOF the City of Springfield, Massachusetts, has caused its corporate seal to be affixed and its name to be signed by Henry Martens, its mayor, thereunto duly authorized by order of

the city council approved by the mayor December 27, 1937, this  
twenty-seventh day of December, 1937.

CITY OF SPRINGFIELD

By Henry Martens  
Mayor

James S. Bulkley

In proper form and  
properly executed;

Donald M. Macauley  
City Solicitor

Mayor's Office  
ROGER L. PUTNAM  
Mayor

City of  
SPRINGFIELD  
Massachusetts

April 21, 1939.

Lieutenant Bettes,  
United States Army Engineers,  
West Springfield, Mass.

Dear Lieutenant Bettes:

Pursuant to the request of your staff, and in accordance with an order approved by the Board of Aldermen and by the Common Council on April 10, 1939 and approved by the mayor on April 10, 1939, and in compliance with the requirements of Section 3 of the Flood Control Act of 1936, the Secretary of War of the United States is hereby assured by the mayor of the City of Springfield that the City of Springfield will comply with the provisions of Section 3 of the Flood Control Act of 1936, in connection with the works shown on a plan entitled "CONNECTICUT RIVER FLOOD CONTROL, SPRINGFIELD DIKE, MEMORIAL BRIDGE TO SOUTH END BRIDGE, CONNECTICUT RIVER, MASSACHUSETTS and dated 1939".

The mayor of Springfield, in accordance with said order of April 10, 1939, does hereby grant to the Secretary of War, all rights necessary for the duly authorized employees or agents of the United States to enter upon and construct the strengthening of Dikework protection from the flood or freshet flows of the Connecticut River, extending along the easterly bank of the Connecticut River, from the Boston and Albany Railroad bridge to the South End bridge and along the course of the Mill River from the Connecticut River easterly to a point easterly of Main Street in said City of Springfield.

All of the necessary land and easements involved will be provided by the City of Springfield.

Three attested copies of the above order of April 10, 1939 are enclosed herewith.

Very truly yours,

/s/ Roger L. Putnam

Mayor

3 COPIES Charter City of Spfld. enclosed.

C I T Y O F S P R I N G F I E L D

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In Board of Aldermen, April 10, 1939.

ORDERED, if the common council concur, that

WHEREAS, by Section 3 of the Flood Control Act approved June 22, 1936 known as the FLOOD CONTROL ACT OF 1936, no money appropriated under authority of said act shall be expended on the construction of any project until States, political subdivisions thereof, or other responsible local agencies have given assurances to the Secretary of War that they will (a) provide without cost to the United States, all lands, easements, and rights-of-way necessary for the construction of the project; (b) hold and save the United States free from damages due to the construction works; (c) maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of War; and

WHEREAS, by the Flood Control Act approved June 28, 1938, local flood protection works were authorized to be constructed in Springfield, Massachusetts, along the easterly bank of the Connecticut River, from the Boston and Albany Railroad bridge to the South End bridge and along the course of the Mill River from the Connecticut River easterly to a point easterly of Main Street which said works are subject to the provisions of Section 3 of the Flood Control Act of 1936; and

WHEREAS, an allotment of funds has been made for the prosecution of said works,

NOW, THEREFORE, to comply with the requirements of said Section 3 of the Flood Control Act of 1936, it is hereby ordered that Roger L. Putnam, mayor of the City of Springfield, be and hereby is authorized and directed to assure the Secretary of War that the City of Springfield will comply with

the above stated provisions of said Section 3 of the Flood Control Act of 1936 in connection with the works shown on the plans entitled "CONNECTICUT RIVER FLOOD CONTROL, SPRINGFIELD DIKE, MEMORIAL BRIDGE TO SOUTH END BRIDGE, CONNECTICUT RIVER, MASSACHUSETTS and dated 1939", which are now on file in the United States Engineer Office, Providence, Rhode Island. In accordance with the established policy of the Corps of Engineers, the City of Springfield will furnish necessary borrow pits with rights of entry thereto,

AND IT IS FURTHER ORDERED that upon the completion of the above mentioned work, as shown on said plans the mayor be and hereby is authorized to accept said work in the name and on behalf of the City of Springfield.

Board of Aldermen Apr 10 1939  
Read, passed and sent down for  
concurrence.  
Clifford F. Smith, Clerk

Common Council Apr 10 1939  
Read and concurred  
Geo J Clark, Clerk

Presented to the Mayor for approval Apr 10 1939  
Clifford F Smith, City Clerk

Mayor's Office, Springfield, Mass., Apr 10 1939  
Approved, Roger L. Putnam, Mayor

A true copy

Attest:

/s/ Clifford F. Smith

City Clerk

ASSURANCE BY THE CITY OF SPRINGFIELD, MASSACHUSETTS

WHEREAS, by Section 3 of the Flood Control Act approved June 22, 1936, known as the Flood Control Act of 1936, no money appropriated under authority of said act shall be expended on the construction of any project until states, political subdivisions thereof, or other responsible local agencies have given assurances to the Secretary of War that they will,

- (a) Provide without cost to the United States, all lands, easements, and rights-of-way necessary for the construction of the project.
- (b) Hold and save the United States free from damages due to the construction works.
- (c) Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of War.

WHEREAS, by the Flood Control Act approved June 28, 1938, local flood protection works were authorized to be constructed in the Connecticut River Basin for the protection of the City of Springfield, Massachusetts, which said works are subject to the provisions of Section 3 of the Flood Control Act of 1936; and

WHEREAS, an allotment of funds has been made for the prosecution of said works.

NOW, THEREFORE, to comply with the requirements of Section 3 of the Flood Control Act of 1936, the City of Springfield, Massachusetts, in accordance with an order passed by the Board of Aldermen and concurred with by the Common Council March 18, 1940 and approved by the mayor March 18, 1940 does hereby assure the Secretary of War that it will comply with the above stated provisions of Section 3 of the Flood Control Act of 1936 in connection with the proposed Mill River



Conduit to be constructed in accordance with plans on file in the United States Engineer Office, Providence, Rhode Island, entitled "Connecticut River Flood Control Project, Springfield, Mass., Connecticut River Massachusetts, Plans for the Construction of Local Protection Works, Item S.3, Mill River Conduit Contract, February 1940." These assurances are also intended to cover such changes in the above described plans as may be found necessary in the prosecution of the work. In accordance with the established policy of the Corps of Engineers the City of Springfield will furnish necessary borrow pits with rights of entry thereto.

IN WITNESS WHEREOF, I, ROGER L. PUTNAM, Mayor of the City of Springfield have hereunto set my hand and caused the common seal of the City of Springfield to be affixed hereto this 22nd day of March 1940.

CITY OF SPRINGFIELD (SEAL)

By /s/ Roger L. Putnam, Mayor

COMMONWEALTH OF MASSACHUSETTS }  
COUNTY OF HAMPDEN } ss.

On this 22nd day of March 1940, before me personally appeared Roger L. Putnam, Mayor, who being by me duly sworn, did depose and say that he is the Mayor of the City of Springfield, described in and who executed the foregoing instrument; that he knows the common seal of the City of Springfield and that the seal affixed to said instrument is such City Seal; that it was so affixed by authority of law of said City and that he signed his name thereto by like authority.

/s/ James M. Carroll  
Notary Public

My Commission Expires March 21, 1942

APPENDIX "C"

PAGE

INSPECTION REPORT FORMS

Dike Inspection Report	C-1
Concrete Wall Inspection Report	C-3
Drainage Structure Inspection Report	C-4
Closure Structure Inspection Report	C-5
Mill River Conduit Inspection Report	C-6

INSPECTION REPORT  
FOR  
FLOOD PROTECTION SYSTEM, SPRINGFIELD, MASS.

Dike Inspection Report (Part 1)

Date \_\_\_\_\_

	<u>Location</u> (from Sta. _____ to Sta. _____)	<u>Description</u>
<u>a.</u> Grass or sod;	_____	_____
	_____	_____
	_____	_____
<u>b.</u> Damage due to fire;	_____	_____
	_____	_____
	_____	_____
<u>c.</u> Rain, wave, current wash or caving banks;	_____	_____
	_____	_____
	_____	_____
<u>d.</u> Damage due to rodents;	_____	_____
	_____	_____
	_____	_____
<u>e.</u> Damage due to live- stock;	_____	_____
	_____	_____
	_____	_____
<u>f.</u> Sand boil areas marked;	_____	_____
	_____	_____
	_____	_____

INSPECTION REPORT  
FOR  
FLOOD PROTECTION SYSTEM, SPRINGFIELD, MASS.

Dike Inspection Report (Part 2)

Date \_\_\_\_\_

Location  
(from Sta. \_\_\_\_\_ to Sta. \_\_\_\_\_)

Description

g. Trespassing on  
Right-of-Way:

_____	_____
_____	_____
_____	_____

h. Damage to toe  
drains:

_____	_____
_____	_____
_____	_____

i. Damage to Riprap:

_____	_____
_____	_____
_____	_____

j. Damage to Dike  
Crown:

_____	_____
_____	_____
_____	_____

Check items if found satisfactory.

If everything is not in order, explain below:

_____
_____
_____

Inspected by: \_\_\_\_\_

INSPECTION REPORT  
FOR  
FLOOD PROTECTION SYSTEM, SPRINGFIELD, MASS.

Concrete Wall Inspection Report

Date: \_\_\_\_\_

a. Monolith joints

(1) Expansion material \_\_\_\_\_

(2) Concrete at joints \_\_\_\_\_

b. Wall

(1) Cracks \_\_\_\_\_

(2) Settlement \_\_\_\_\_

(3) Caving of banks \_\_\_\_\_

(4) Bank protection \_\_\_\_\_

(5) Toe drains \_\_\_\_\_

c. Trespassing on right-of-way

(1) Excavation \_\_\_\_\_

(2) Depositing materials \_\_\_\_\_

(3) Construction \_\_\_\_\_

(4) Fires \_\_\_\_\_

Check items if found satisfactory.

If everything is not in order, explain below:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Inspected by: \_\_\_\_\_

INSPECTION REPORT  
FOR  
FLOOD PROTECTION SYSTEM, SPRINGFIELD, MASS.

Drainage Structure Inspection Report

Date \_\_\_\_\_

	<u>Location</u>	<u>Condition</u>
<u>a.</u> Valves or gates:	_____	_____
	_____	_____
	_____	_____
<u>b.</u> Pipe:	_____	_____
	_____	_____
	_____	_____
<u>c.</u> Headwalls:	_____	_____
	_____	_____
	_____	_____
<u>d.</u> Riprap:	_____	_____
	_____	_____
	_____	_____
<u>e.</u> Catch Basins:	_____	_____
	_____	_____
	_____	_____
<u>f.</u> Stone Gutters:	_____	_____
	_____	_____
	_____	_____

Check items if found satisfactory.

If everything is not in order, explain below:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Inspected by: \_\_\_\_\_

INSPECTION REPORT  
FOR  
FLOOD PROTECTION SYSTEM, SPRINGFIELD, MASS.

Closure Structure Inspection Report

Date \_\_\_\_\_

Closures

	:	No. 1	:	No. 2	:	No. 3	:	No. 4	:	Draft
North End:		Foot		Foot		South:		North		Tubes
U E L Co.:		of		of		Mill		South		Bay State
Bldg.		Bliss St.		Union St.		River		End Bridge		Thread Co.

<u>a.</u> Concrete						
<u>b.</u> Metal Parts						
<u>c.</u> Timbers						
<u>d.</u> Repairs Needed						
<u>e.</u> Parts Needing Paint						
<u>f.</u> Date of Last Trial Erection						
<u>g.</u> Sand Bags Available						

Check items if found satisfactory.

If everything is not in order, explain below:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Inspected by: \_\_\_\_\_

INSPECTION REPORT  
FOR  
FLOOD PROTECTION SYSTEM, SPRINGFIELD, MASS.

Mill River Conduit Inspection Report

Date \_\_\_\_\_

- a. Concrete \_\_\_\_\_
- b. Monolith Joints \_\_\_\_\_
- c. Pressure Manholes \_\_\_\_\_
- d. Sewer Connections \_\_\_\_\_
- e. Settlement \_\_\_\_\_
- f. Entrance Channel \_\_\_\_\_
- g. Exit Channel \_\_\_\_\_
- h. Debris in Conduit \_\_\_\_\_
- i. Riprap & Derrick Stone \_\_\_\_\_
- j. Head Gate Bay State Thread Co. \_\_\_\_\_
- k. Draft Tubes Bay State Thread Co. \_\_\_\_\_
- l. Paint on Exposed Metal \_\_\_\_\_
- m. Backfill or Embankment \_\_\_\_\_

Check items if found satisfactory.

If everything is not in order, explain below:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Inspected by: \_\_\_\_\_



## APPENDIX "D"

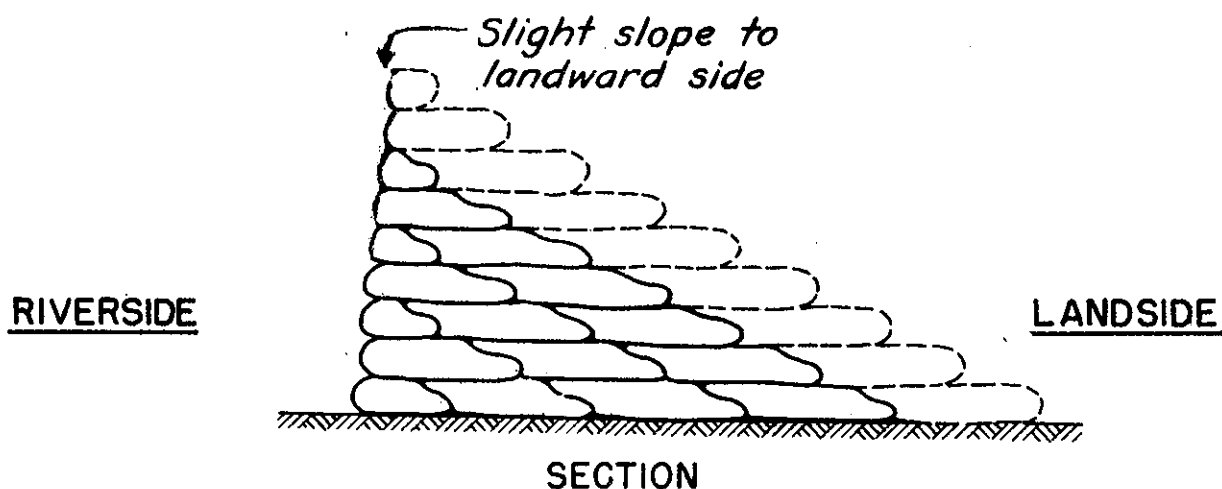
### DRAWINGS

	PLATE
STANDARD HIGHWATER MAINTENANCE METHODS	
Sack Dike or Topping	I
Lumber and Sack Topping	II
Sand Boil	III
Sacking Sloughs	IV
Emergency Flash Boards	V
OPERATIONS	
Location Map and Schedule of Operations	VI
Pertinent Features	VII to XXVI
PLANS AND PROFILES	
North End Bridge to Chicopee Town Line	XXVII to XXXI
Above North End Bridge	XXXII
South of North End Bridge	XXXIII to XXXIV
Memorial Bridge to South End Bridge	XXXV to XXXVIII
Mill River Conduit	XXXIX to XLIII

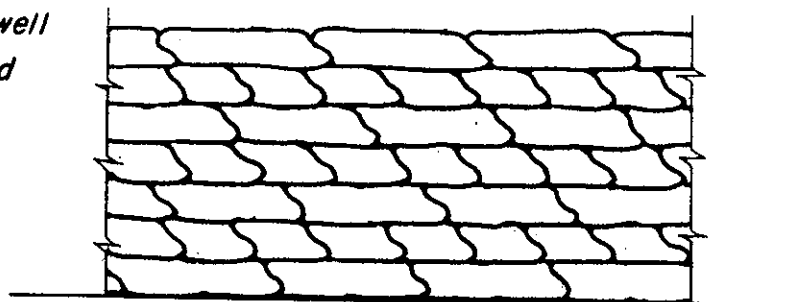
### BENCH MARKS

Listed below are descriptions of three U. S. Coast and Geodetic Survey bench marks. The elevations shown are on mean sea level datum.

1. A standard disk stamped "B 1923" set in the top of a concrete post and located 75 feet north of the South End Bridge, 105 feet east of the east rail of the New York, New Haven & Hartford Railroad, and 7 feet north of a fire plug. Elevation 59.852 feet.
2. A standard disk, stamped "Z 5 1933" set in the top of the north end of the back wall of the east concrete abutment of the Boston & Albany Railroad Bridge, 12 feet north of the center line of the westbound track, and 6 inches lower than the top of the rail. Elevation 73.382 feet.
3. A standard disk, set in the top of a concrete post, about 111 feet north of the Boston & Maine Railroad station platform, about 65 feet south of the center line of Wason Avenue, 11.8 feet west of the most westerly rail, and 1.4 feet west of the west edge of a brick walk leading from Wason Avenue to the station. Elevation 61.591 feet.



*Note: Sacks should be lapped at least 1/3 all ways and well mauled or tamped into place.*



### RIVERSIDE ELEVATION

SACKS REQUIRED PER 100' STA.  
100 lb. "Feed" Sacks - 1 Cu. Ft. Each

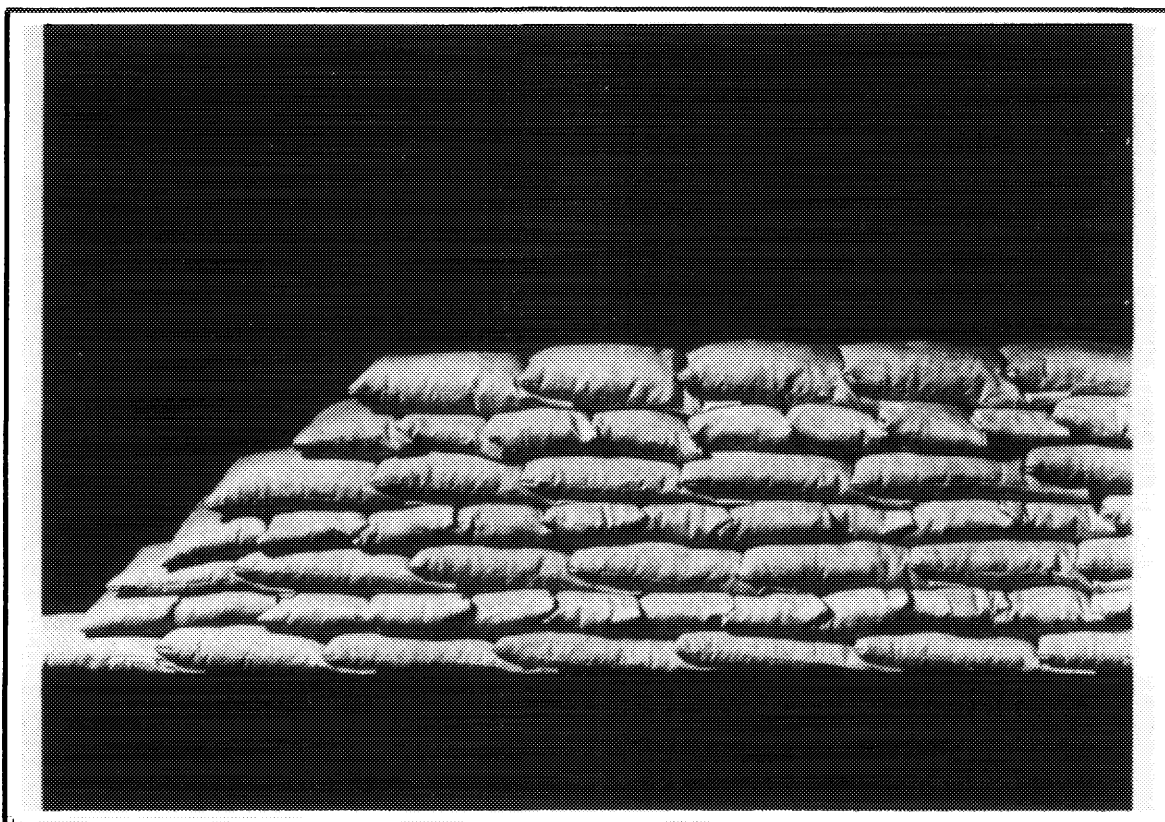
Approx. Hgt. Sack Dike	Sacks High	Required
1.5	3	300
2.0	4	750
3.0	6	1400
4.0	8	2250
5.0	10	3250
6.0	12	4500
7.0	14	5950
8.0	16	7600

SACK DIKE OR TOPPING  
STANDARD HIGH WATER  
MAINTENANCE INSTRUCTION

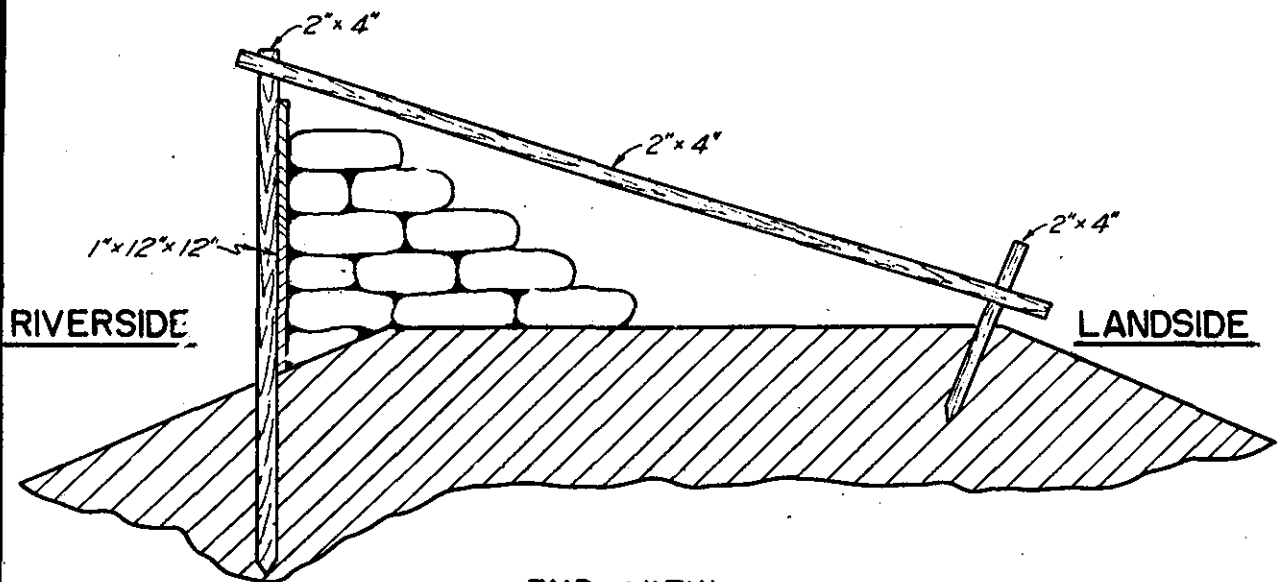
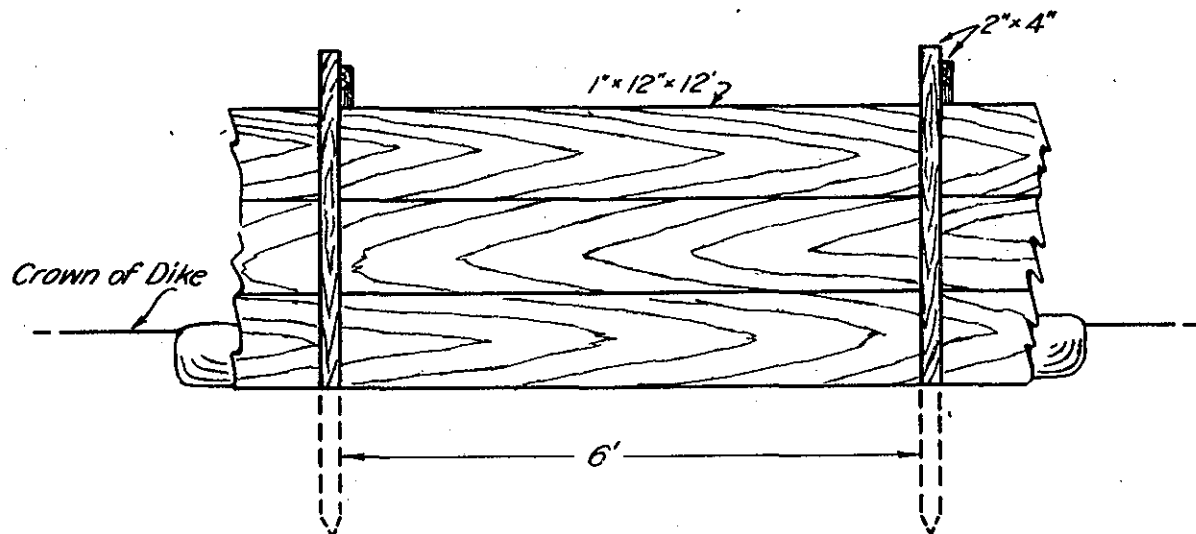
U. S. ENGINEER OFFICE, PROVIDENCE, R. I.



MODEL SACK DIKE OR TOPPING  
Typical Section



MODEL SACK DIKE OR TOPPING  
Riverside View

END VIEWFRONT ELEVATIONBILL OF MATERIAL TO CONSTRUCT 100 FEET

25 pcs. 1"x12"x12'

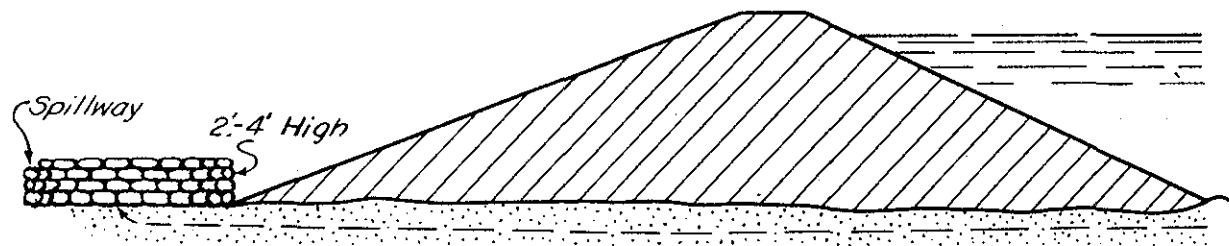
17 pcs. 2"x4"x6'

17 pcs. 2"x4"x10'

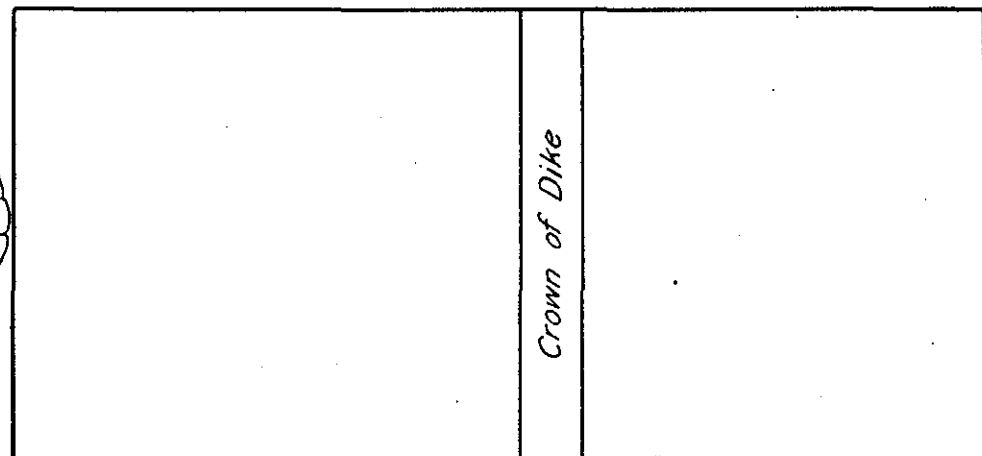
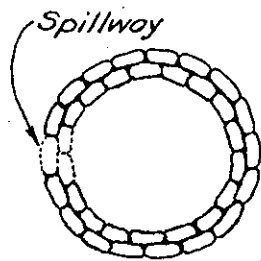
17 pcs. 2"x4"x2'

**LUMBER AND SACK TOPPING  
STANDARD HIGH WATER  
MAINTENANCE INSTRUCTION**

U. S. ENGINEER OFFICE, PROVIDENCE, R.I.



Wall should be built on firm ELEVATION  
 foundation, with width of base  
 at least  $1\frac{1}{2}$  times the height.  
 Be sure to place sacks on ground  
 clear of sand discharge.  
 Tie into dike if boil is near toe.

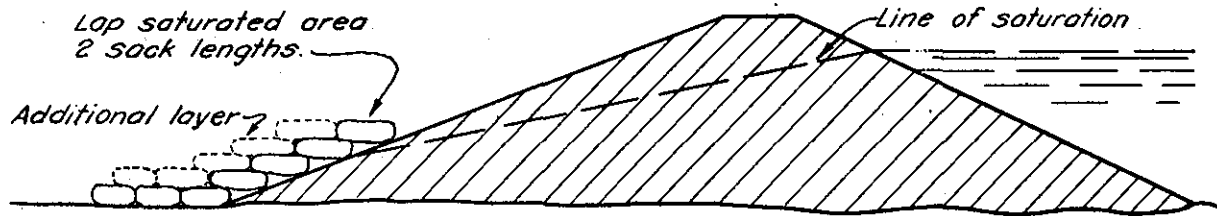


PLAN

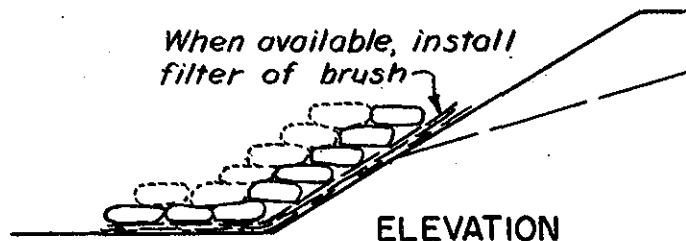
*Do not sack boil which  
 does not put out material.  
 Height of sack loop or ring  
 should be only sufficient to  
 create enough head to slow  
 down flow through boil so  
 that no more material is dis-  
 placed and boil runs clear.  
 Do not try to stop fully, flow  
 through boil.*

**SAND BOIL  
 STANDARD HIGH WATER  
 MAINTENANCE INSTRUCTION**

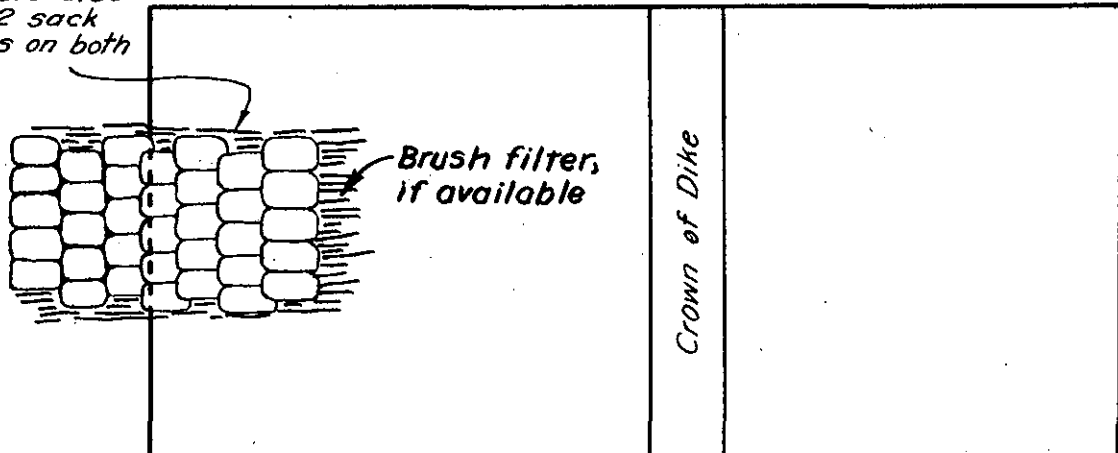
U. S. ENGINEER OFFICE, PROVIDENCE, R. I.

ELEVATION

*Number of layers determined by velocity of seepage and amount of material being carried.*

ELEVATION

*Lap saturated area 2 sack widths on both ends.*

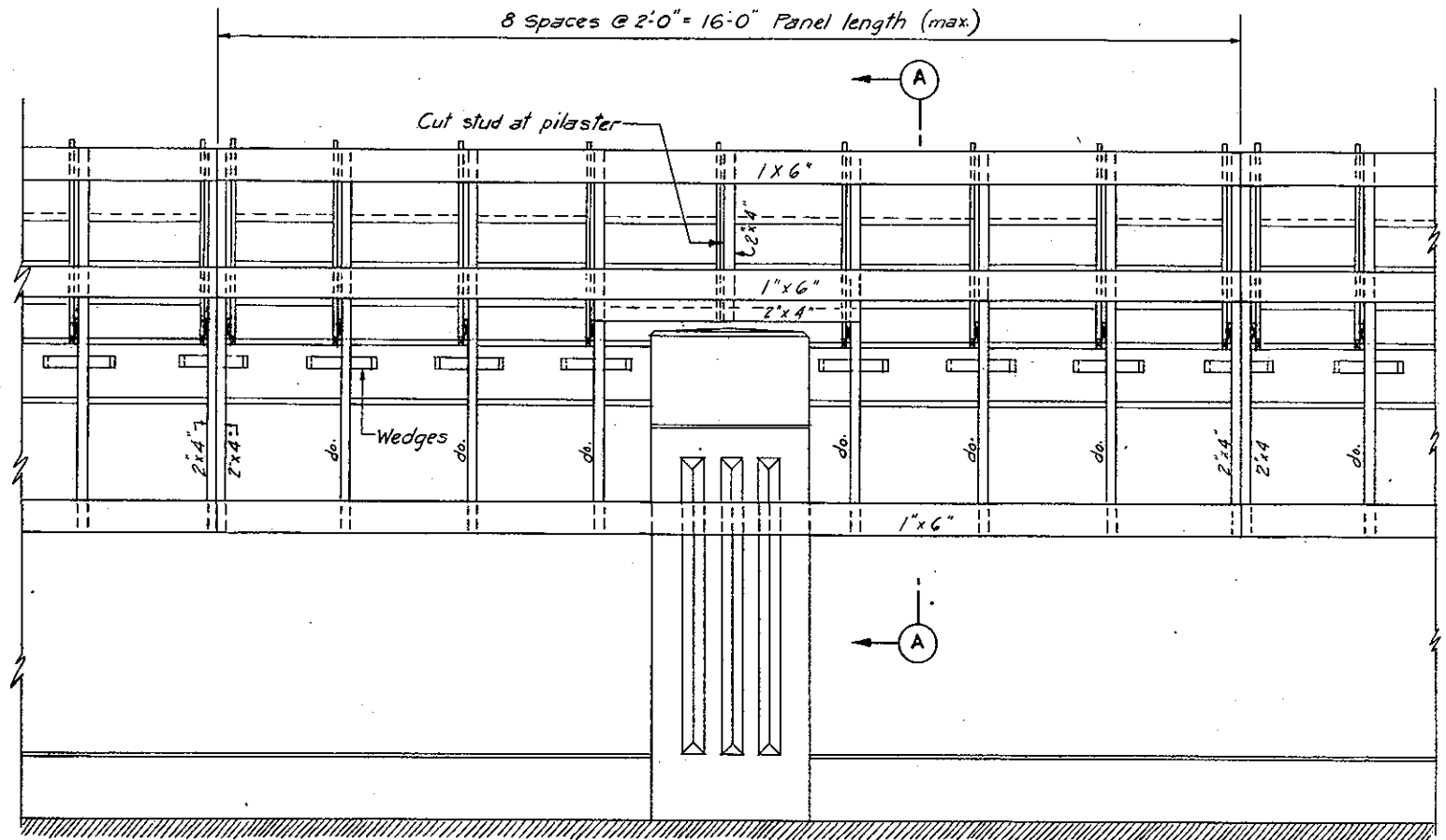
PLAN

*Sacks should be laid shingle fashion and not mounded into place.*

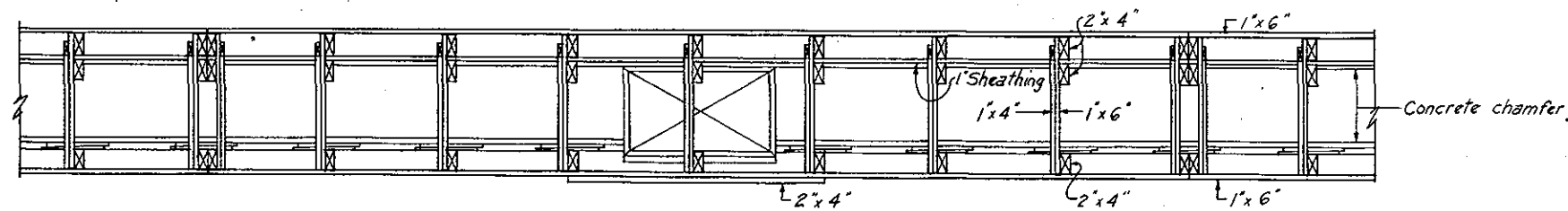
**SACKING SLOUGHS  
STANDARD HIGH WATER  
MAINTENANCE INSTRUCTION**

U. S. ENGINEER OFFICE, PROVIDENCE, R. I.

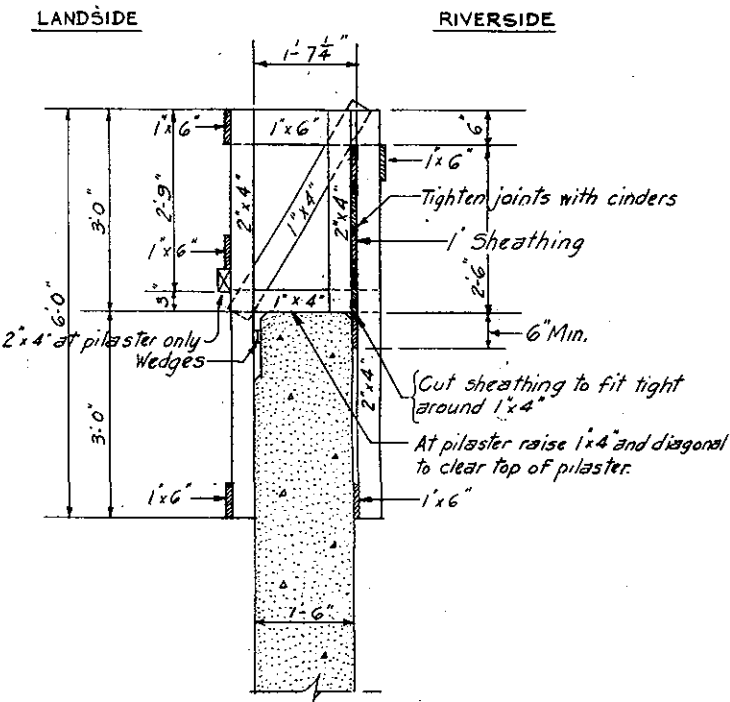
BILL OF MATERIALS			
For one 8'-0" panel. Regular wall section.			
Uprights	10 pcs	2" x 4" x 6'-0"	
Vert. brace	5 "	2" x 4" x 3'-0"	
Stringers	5 "	1" x 6" x 8'-0"	
Upper ties	5 "	1" x 6" x 2'-3"	
Lower ties	5 "	1" x 4" x 2'-3"	
Diagonals	5 "	1" x 4" x 3'-6"	
Sheathing	6 "	1" x 6" x 8'-0" or random widths to make up 36'	
Wedges	8	(1/2 to 1 1/2") x 2" x 1'-0" + 1-3" x 2" x 4'-0"	
For one 8'-0" panel. Pilaster section			
Same as above list except:			
Substitute one upright 2" x 4" x 2'-9" for one 2" x 4" x 6'-0"			
Add one stringer piece 2" x 4" x 4'-2"			



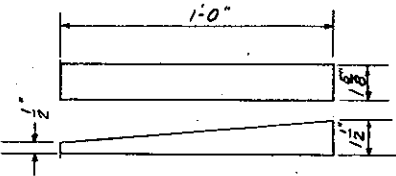
LANDSIDE ELEVATION



PLAN



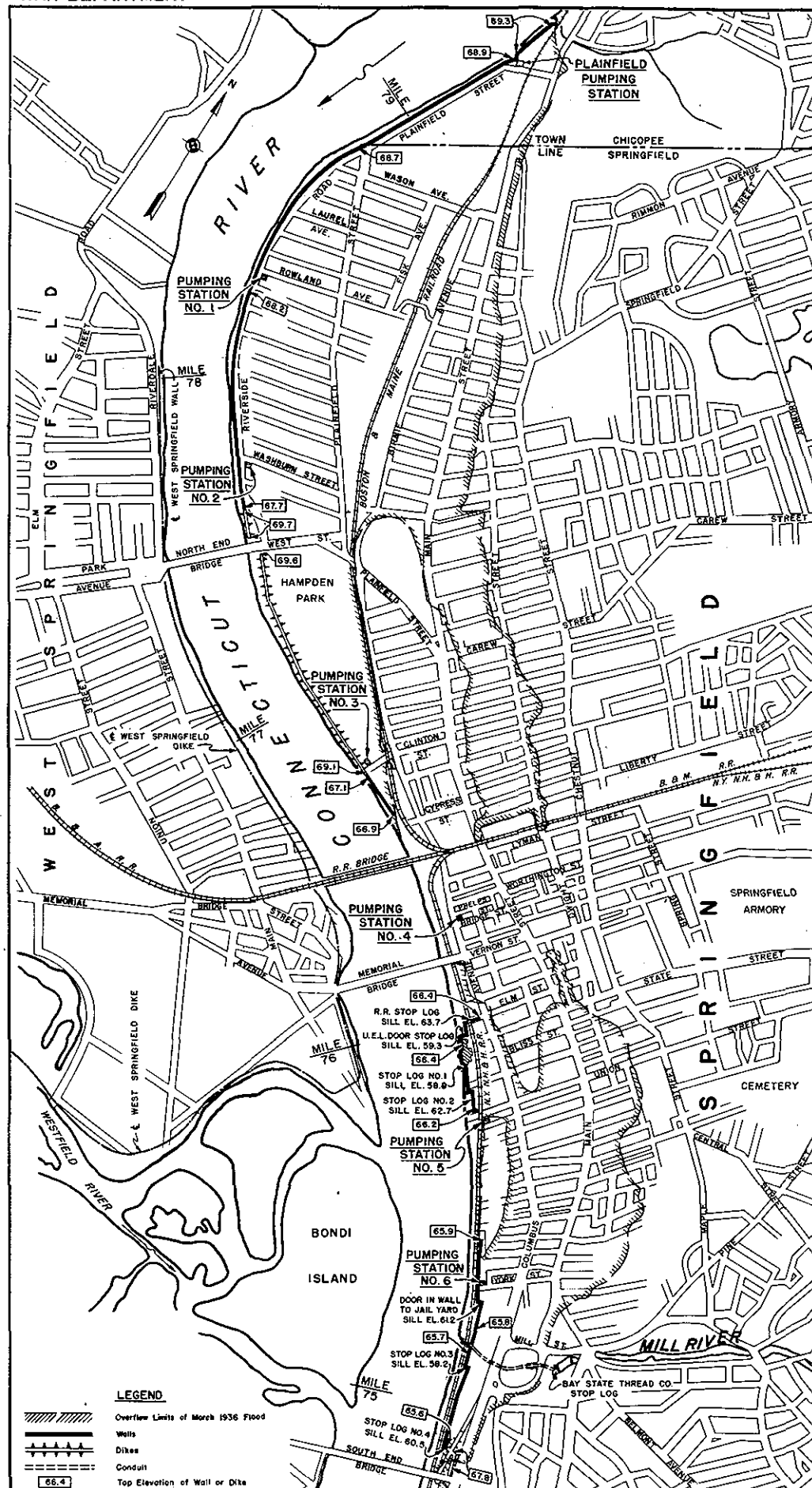
SECTION A-A



WEDGE

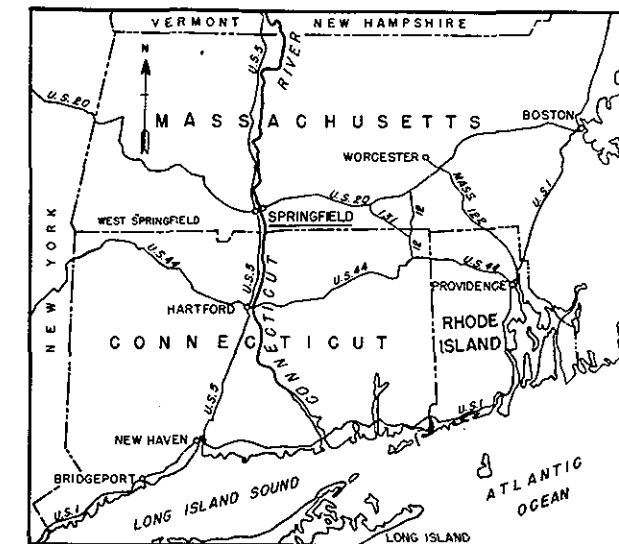
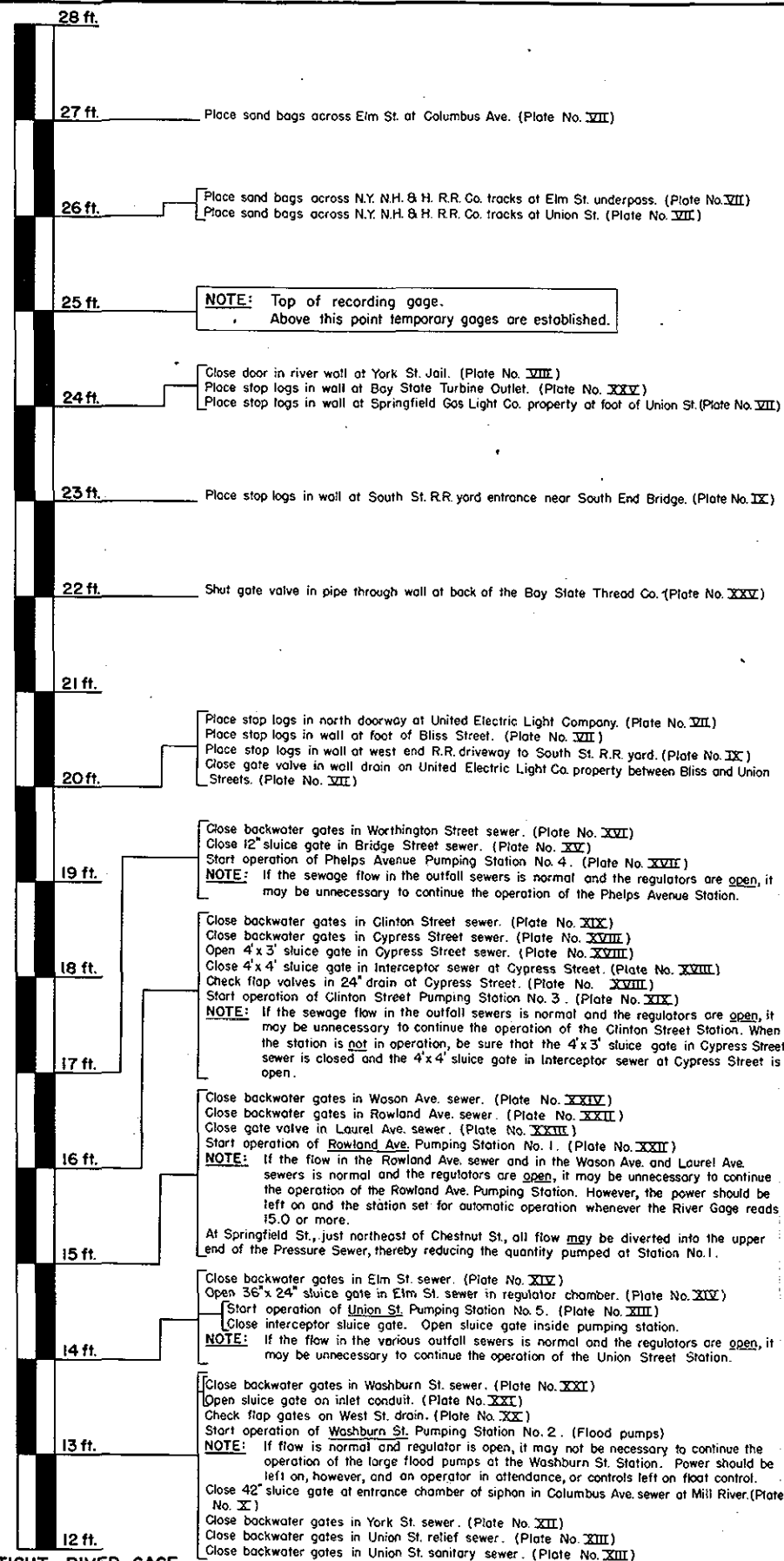
KEY	DATE	REVISION (Indicated by $\Delta$ )	REV BY	CHK BY	AP BY

CONNECTICUT RIVER FLOOD CONTROL			
EMERGENCY FLASH BOARDS			
FOR FLOOD WALLS			
CONNECTICUT RIVER		MASSACHUSETTS	
IN 1 SHEETS		SHEET NO. 1	
SCALE: 3/4" = 1'-0"			
U.S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1945			
SUBMITTED: <i>E. J. M.</i>		APPROVAL RECOMMENDED: <i>W. J. Truss</i>	
SENIOR ENGINEER		COL. CORPS OF ENGINEERS	
HEAD ENGINEER		CHIEF, ENGINEERING DIV.	
PREPARED: <i>E. J. M.</i>		DRAWN: <i>E. J. M.</i>	
SYMBOLICAL SECTION		CHECKED: <i>E. J. M.</i>	
		FILE NO. CT-4-3408	



## CONNECTICUT RIVER GAGE

RECORDING GAGE LOCATED IN WESTERLY PIER  
CENTER SPAN, MEMORIAL BRIDGE, SPRINGFIELD, MASS.  
ZERO OF GAGE IS ELEVATION 37.3 MEAN SEA LEVEL.



## LOCATION MAP

SCALE OF MILES  
0 10 20 30

## NOTES

## STOP LOGS

When the elevation of the Connecticut River reaches El. 57.3 or river gage reads 20 feet, Stop Logs should be delivered at the following locations and should be in position when the river gage reaches the readings shown below.

- Gage 20 ft. (1) North doorway at United Electric Light Company. Elev. 59.3
- Gage 20 ft. (2) Riverwall at foot of Bliss St. Elev. 58.8
- Gage 20 ft. (3) Riverwall at west end R.R. driveway to South St. R.R. yard. Elev. 58.2
- Gage 23 ft. (4) South St. R.R. yard entrance near South End Bridge. Elev. 60.5
- Gage 24 ft. (5) Riverwall at Spfld. Gas Light Co. foot of Union Street. Elev. 62.7
- Gage 24 ft. (6) Wall at turbine outlets Bay State Thread Co.

## SAND BAGS

Sand bags should be filled and delivered to the following locations when the river reaches elevation 57.3 or the river gage reads 20.0

SAND BAGS SHOULD BE PLACED IN POSITION AT RIVER GAGE READINGS SHOWN BELOW

- Gage 20 ft. (1) Riverwall at foot of Bliss Street
- Gage 20 ft. (2) Riverwall at west end of R.R. driveway to South St. R.R. yard
- Gage 23 ft. (3) South St. R.R. yard entrance near South End Bridge
- Gage 24 ft. (4) Door in Riverwall at York St. Jail
- Gage 24 ft. (5) Riverwall at Spfld. Gas Light Co., foot of Union St.
- Gage 26 ft. (6) N.Y. N.H. & H. R.R. Co. tracks at Elm St. underpass
- Gage 26 ft. (7) N.Y. N.H. & H. R.R. Co. tracks at Union Street
- Gage 27 ft. (8) Elm Street at Columbus Avenue

CONNECTICUT RIVER FLOOD CONTROL  
FLOOD PROTECTION SYSTEM  
SPRINGFIELD, MASS.  
OPERATIONS CHART

IN 1 SHEETS SCALE: 1 IN. = 800 FT. SHEET NO. 1

U. S. ENGINEER OFFICE, PROVIDENCE, R. I., MARCH 1945

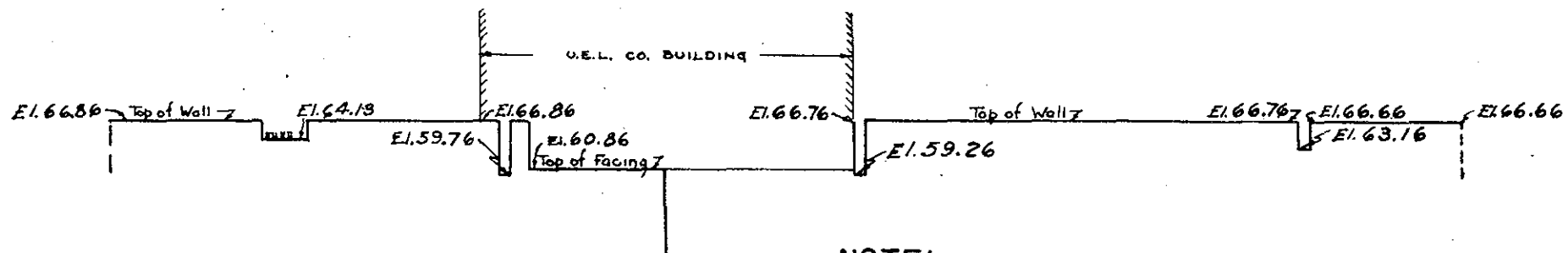
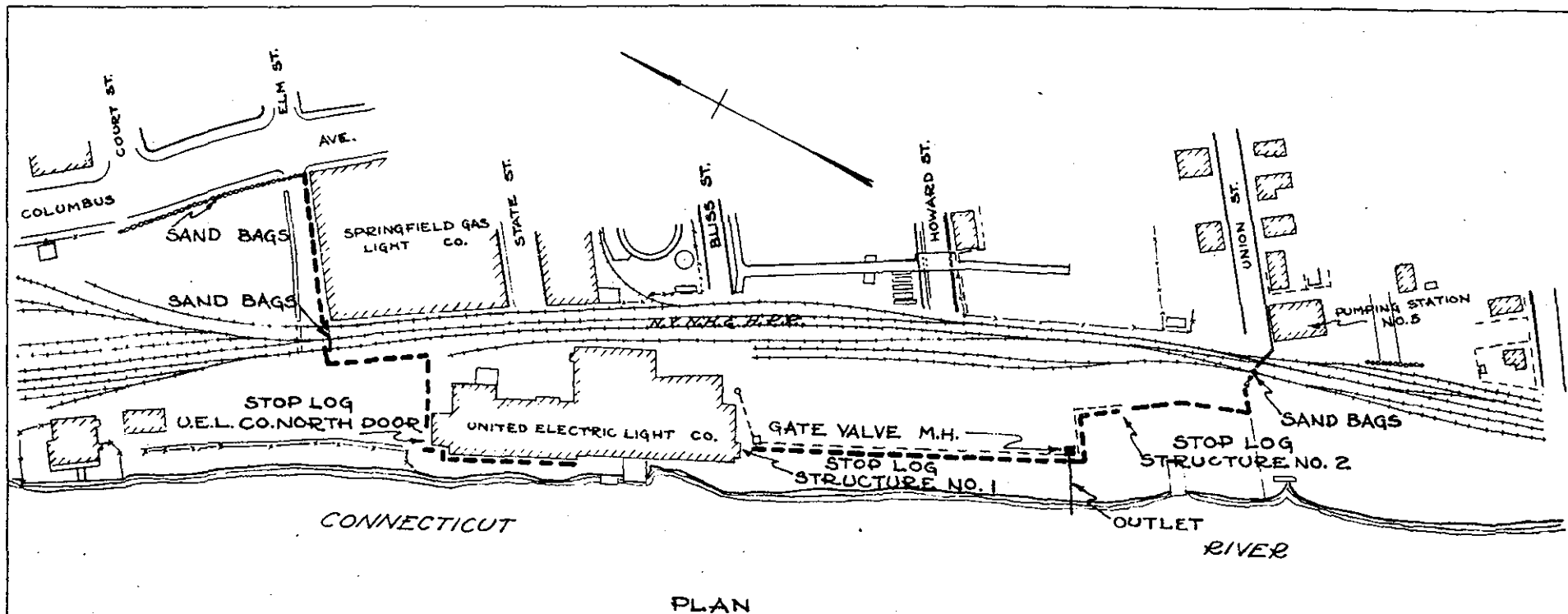
SUBMITTED: *James A. Egan* APPROVAL: *Carl A. Lawrence* APPROVED: *John S. Jones*

SENIOR ENGINEER SENIOR ENGINEER & CHIEF OPERATIONS DIVISION COL. CORPS OF ENGINEERS DISTRICT ENGINEER

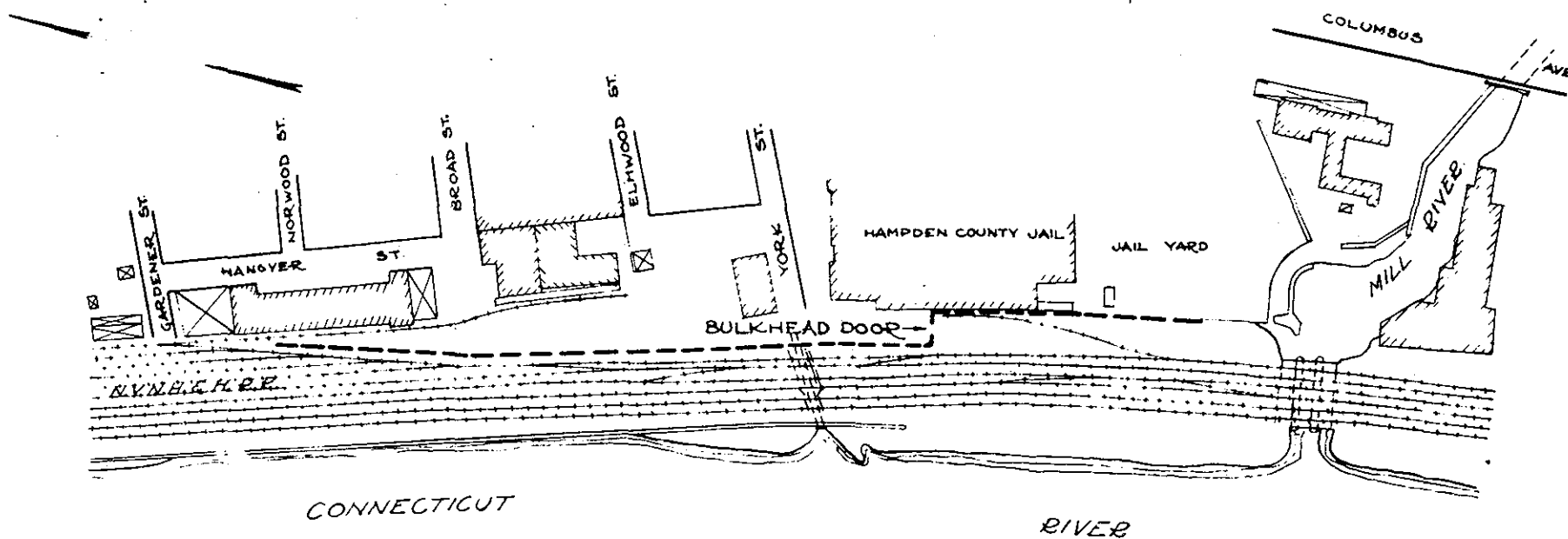
DRAWN: D. H. R. L. H. TRACED: D. H. R. L. H. CHECKED: *John S. Jones*

FILE NO. CT-4-3443

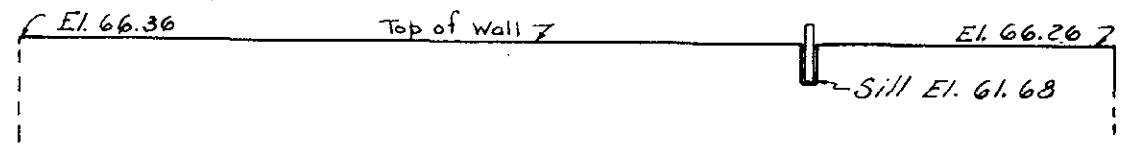




**NOTE:**  
 Elevations shown are on city datum.  
 Subtract 0.46 to convert to M.S.L.

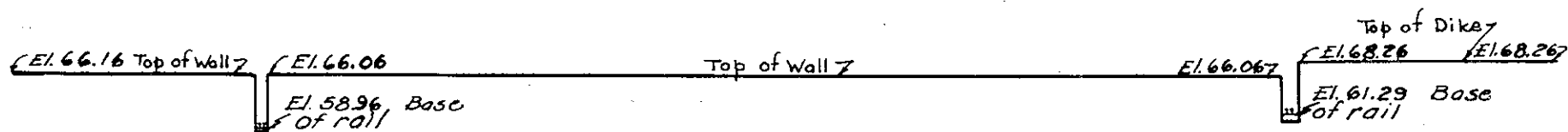
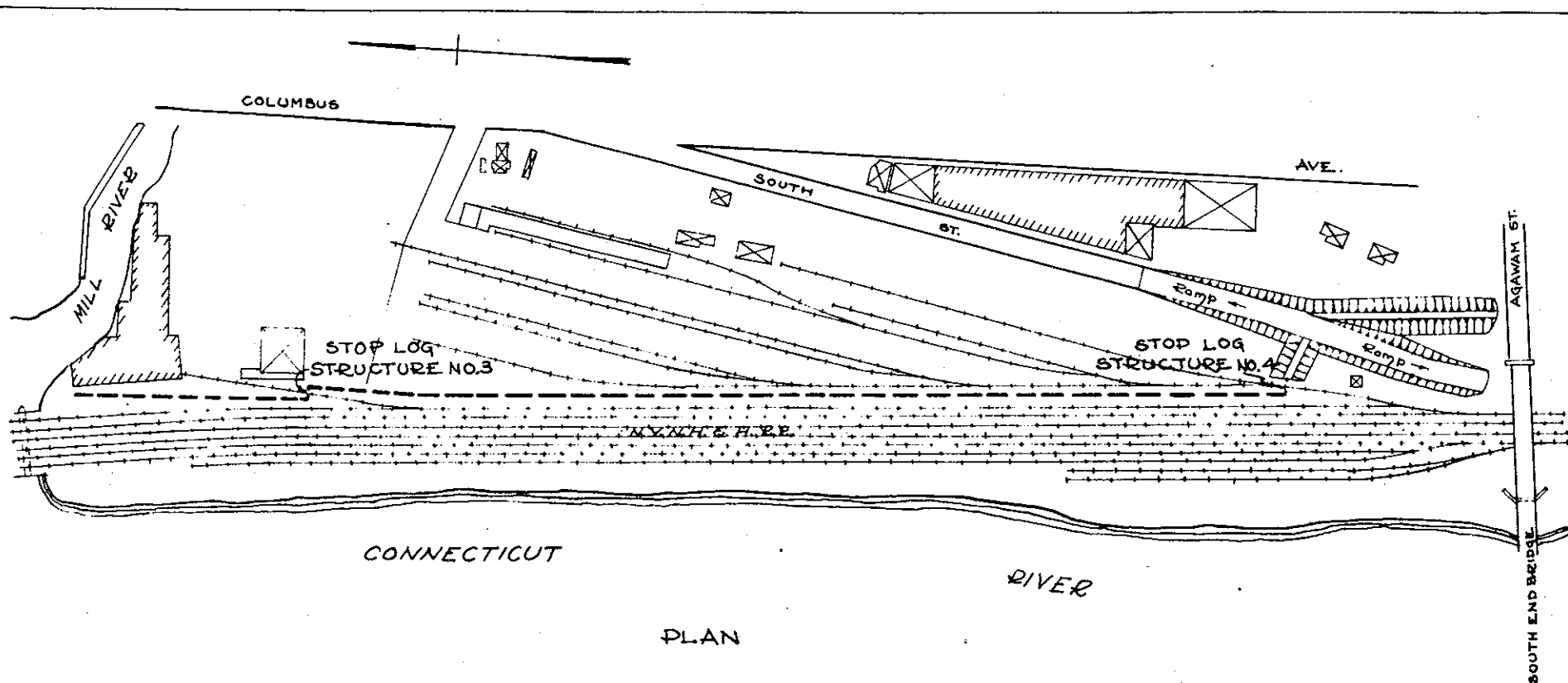


PLAN

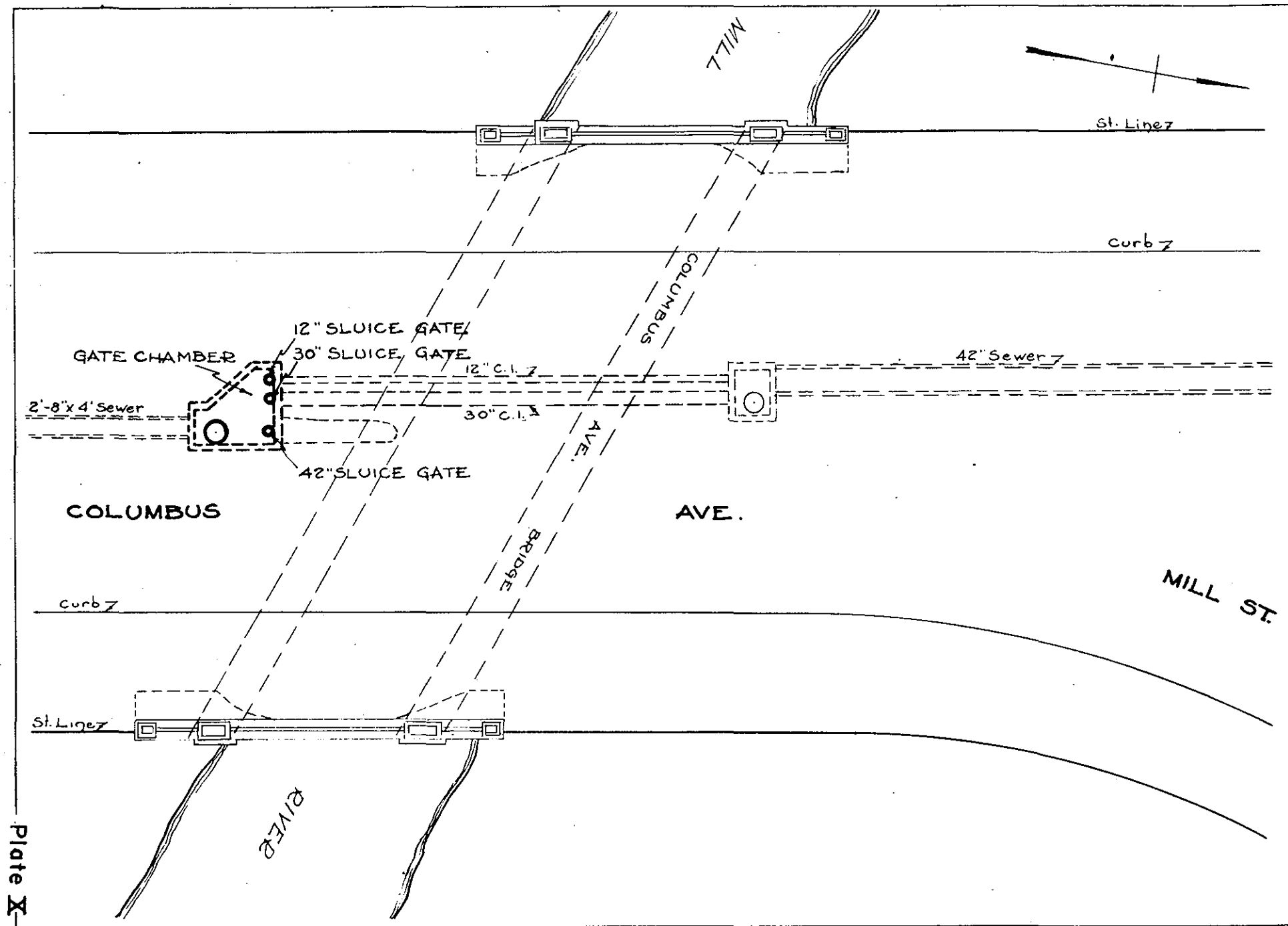


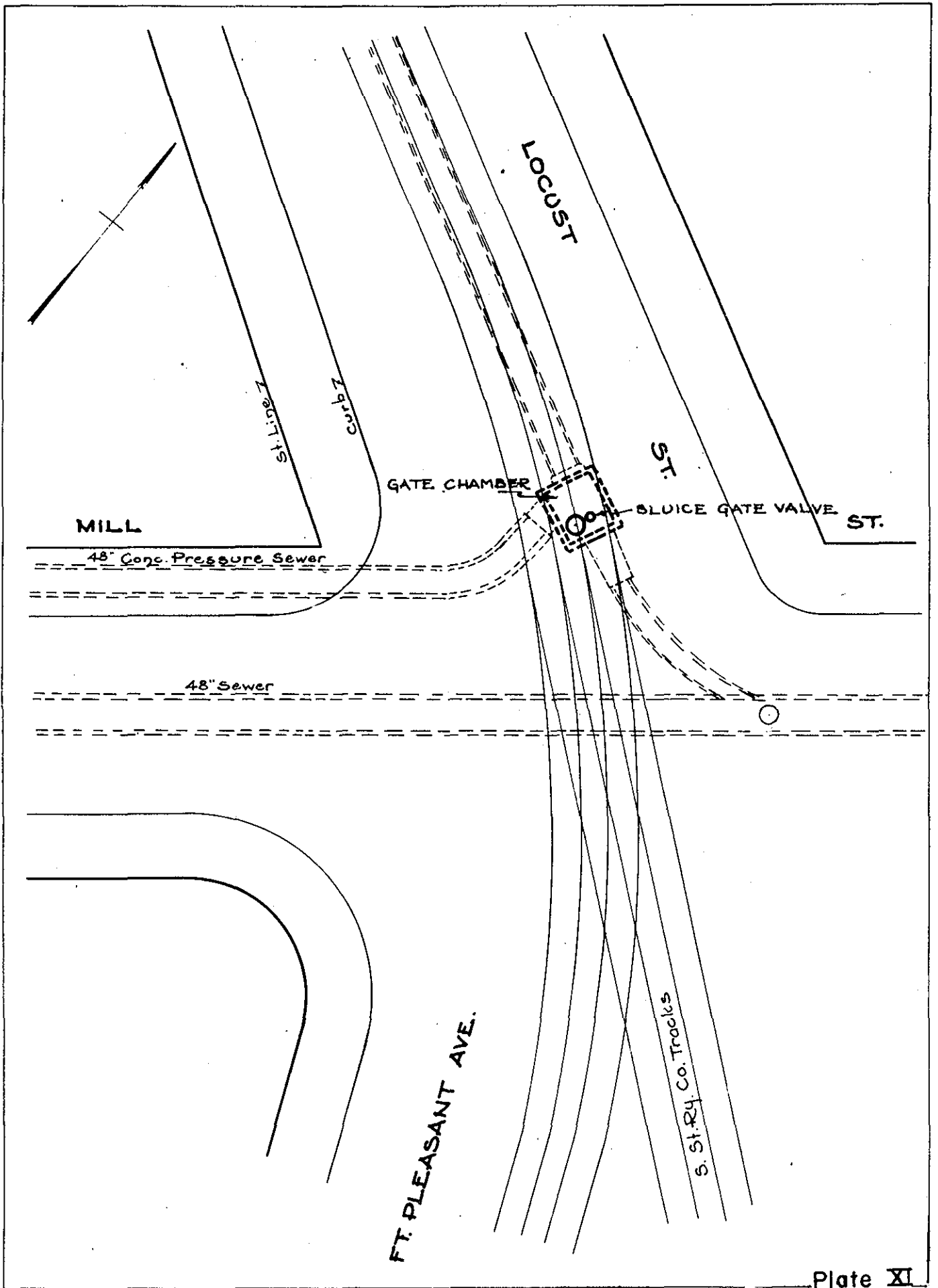
PROFILE

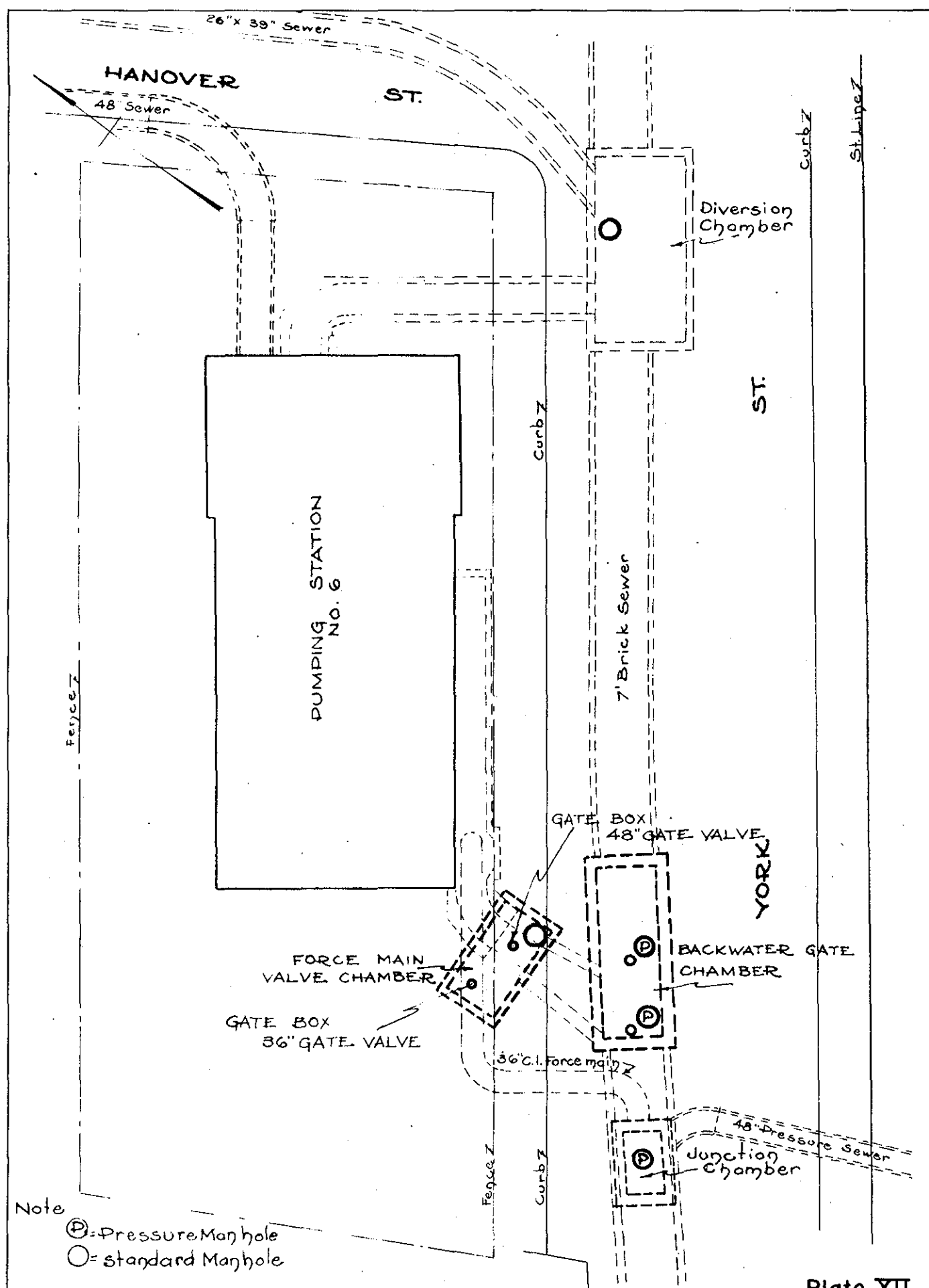
NOTE:  
 Elevations shown are on city datum.  
 Subtract 0.46 to convert to M.S.L.

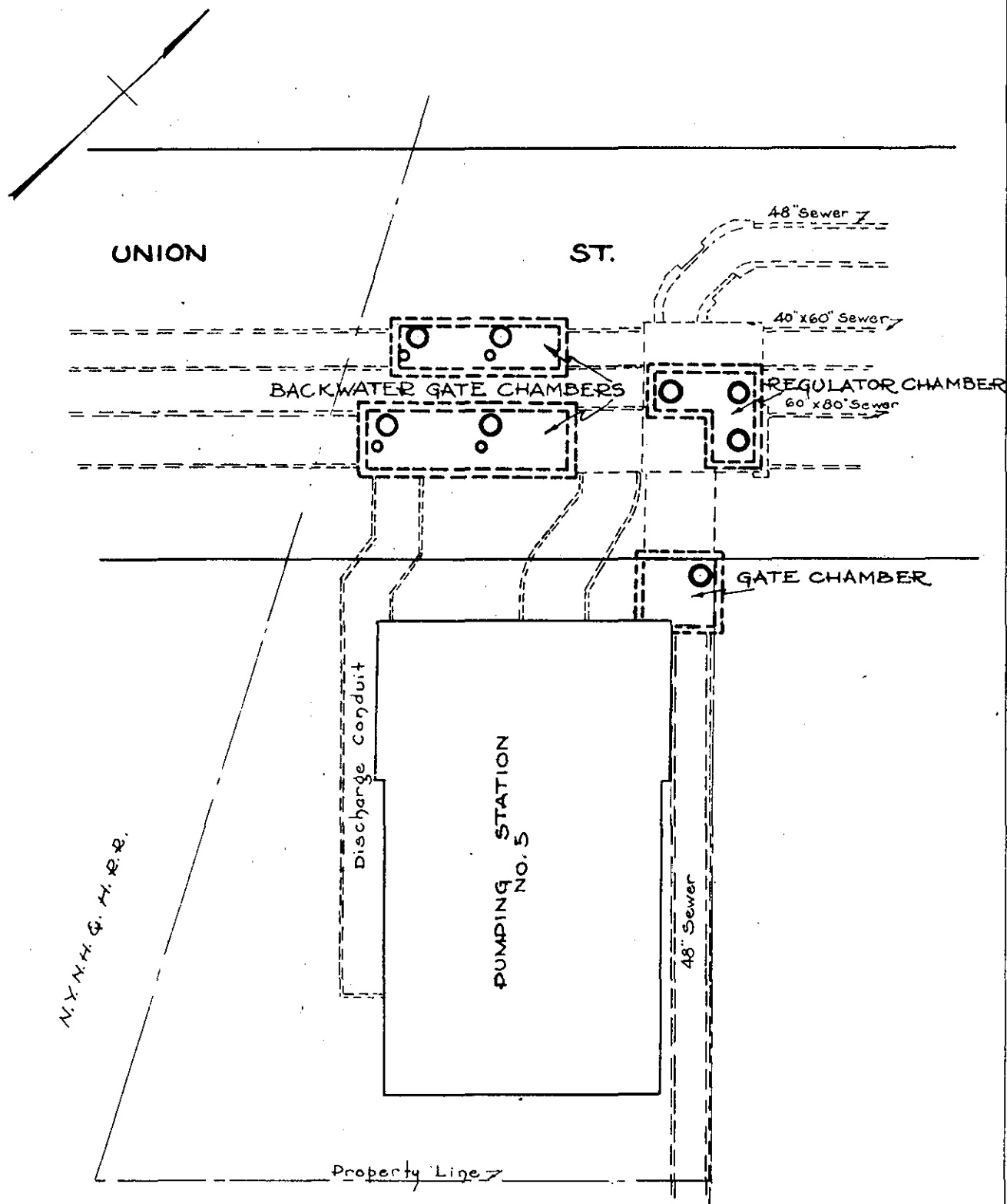


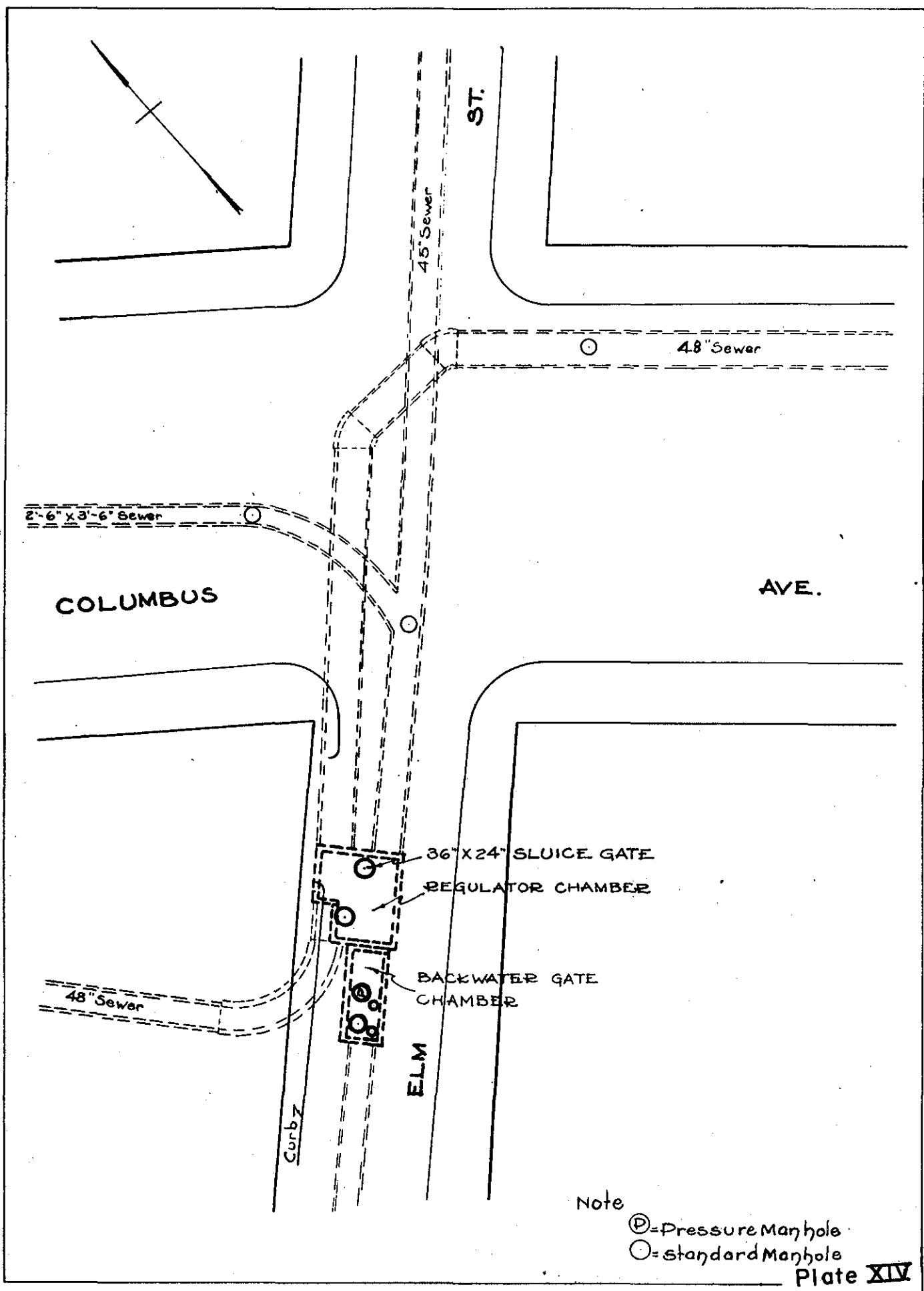
NOTE:  
 Elevations shown are on city datum.  
 Subtract 0.46 to convert to M.S.L.



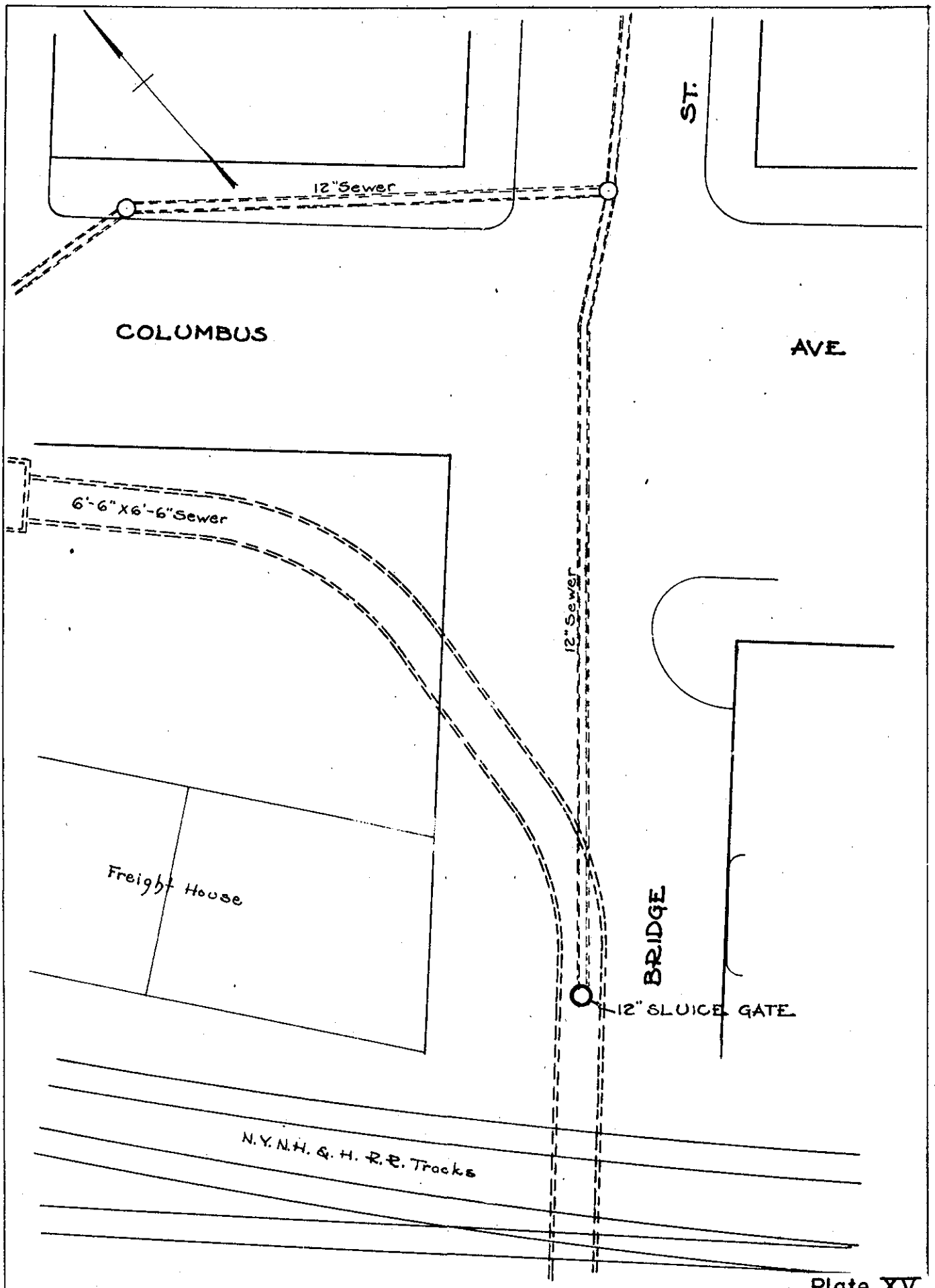


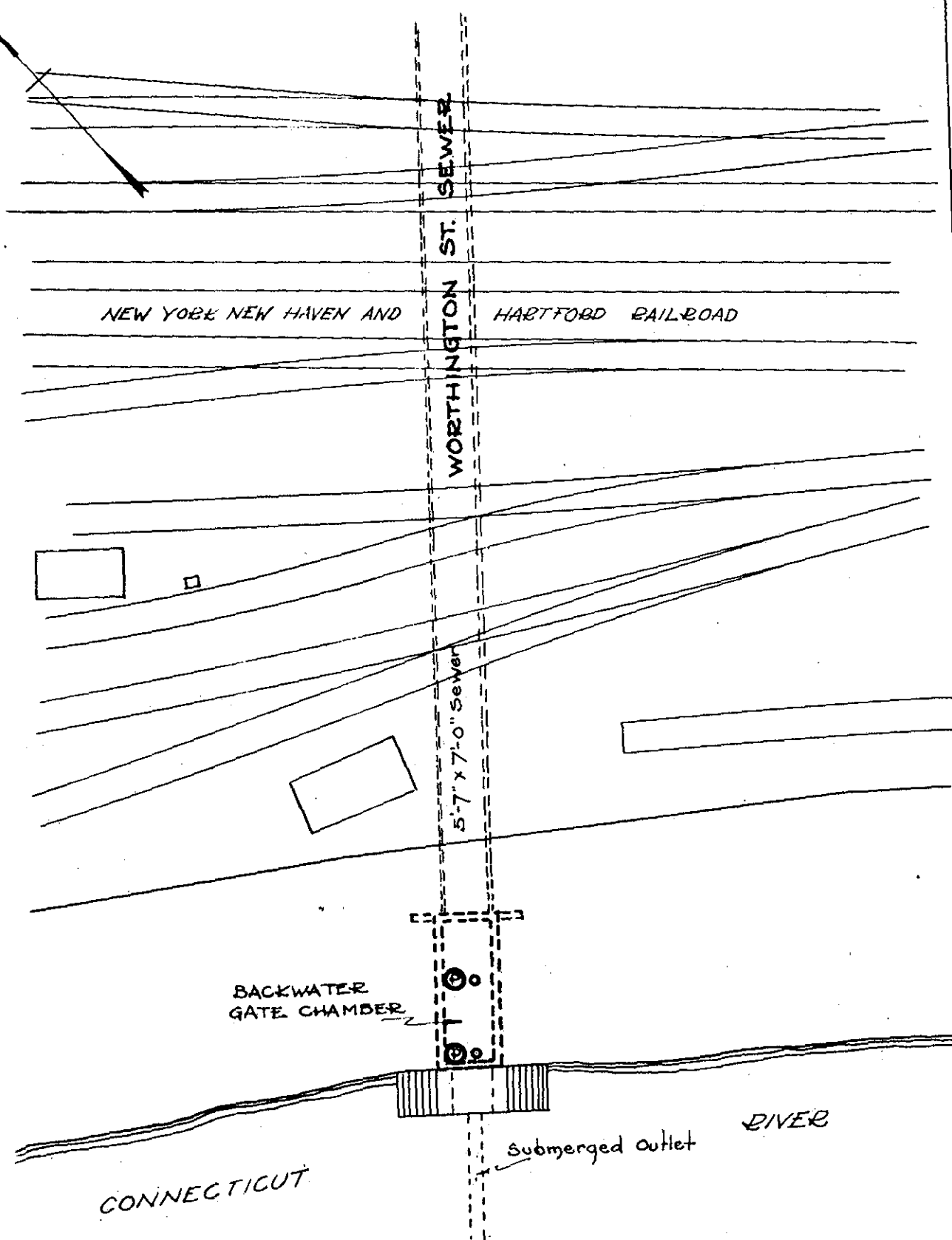








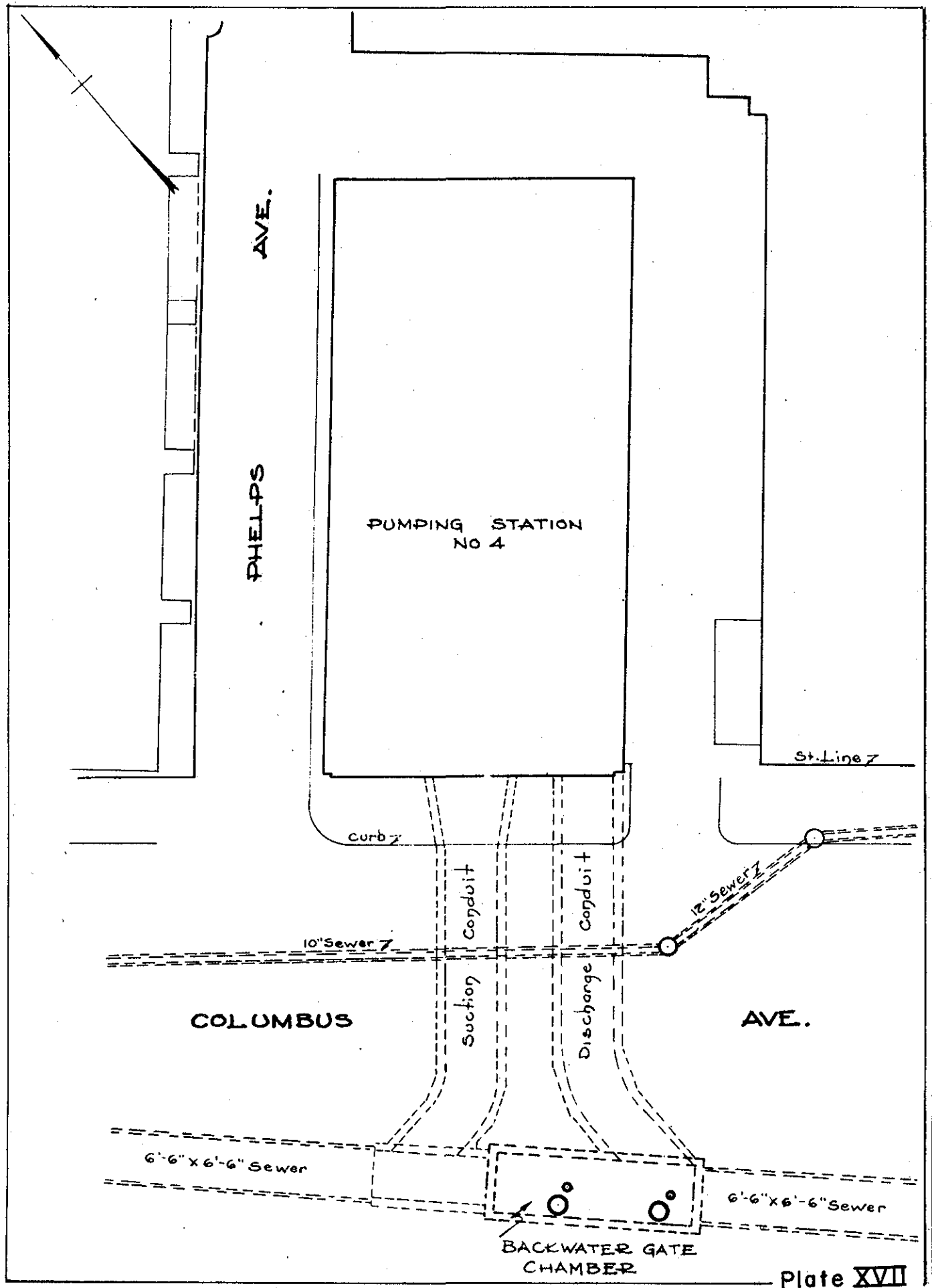


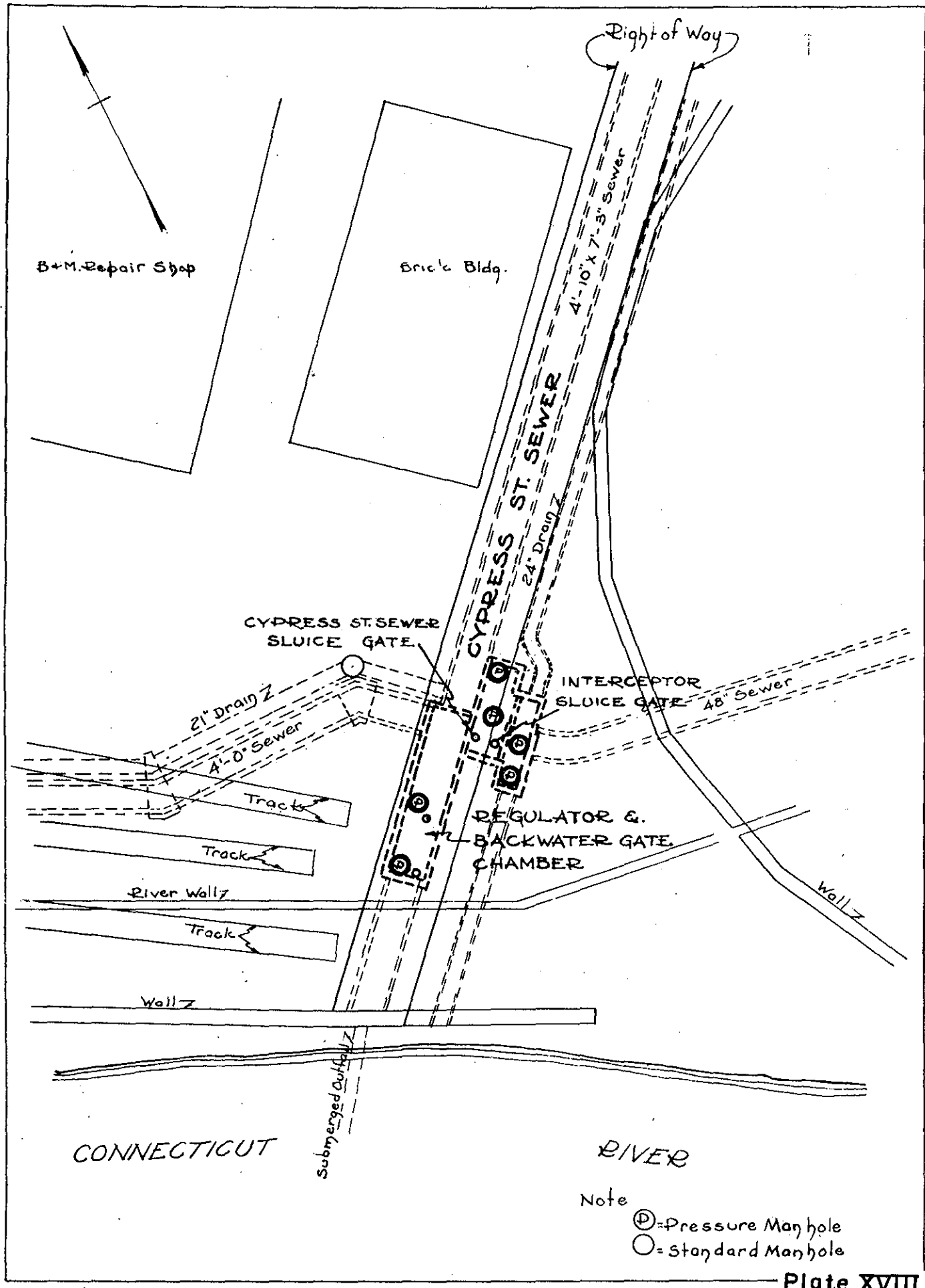


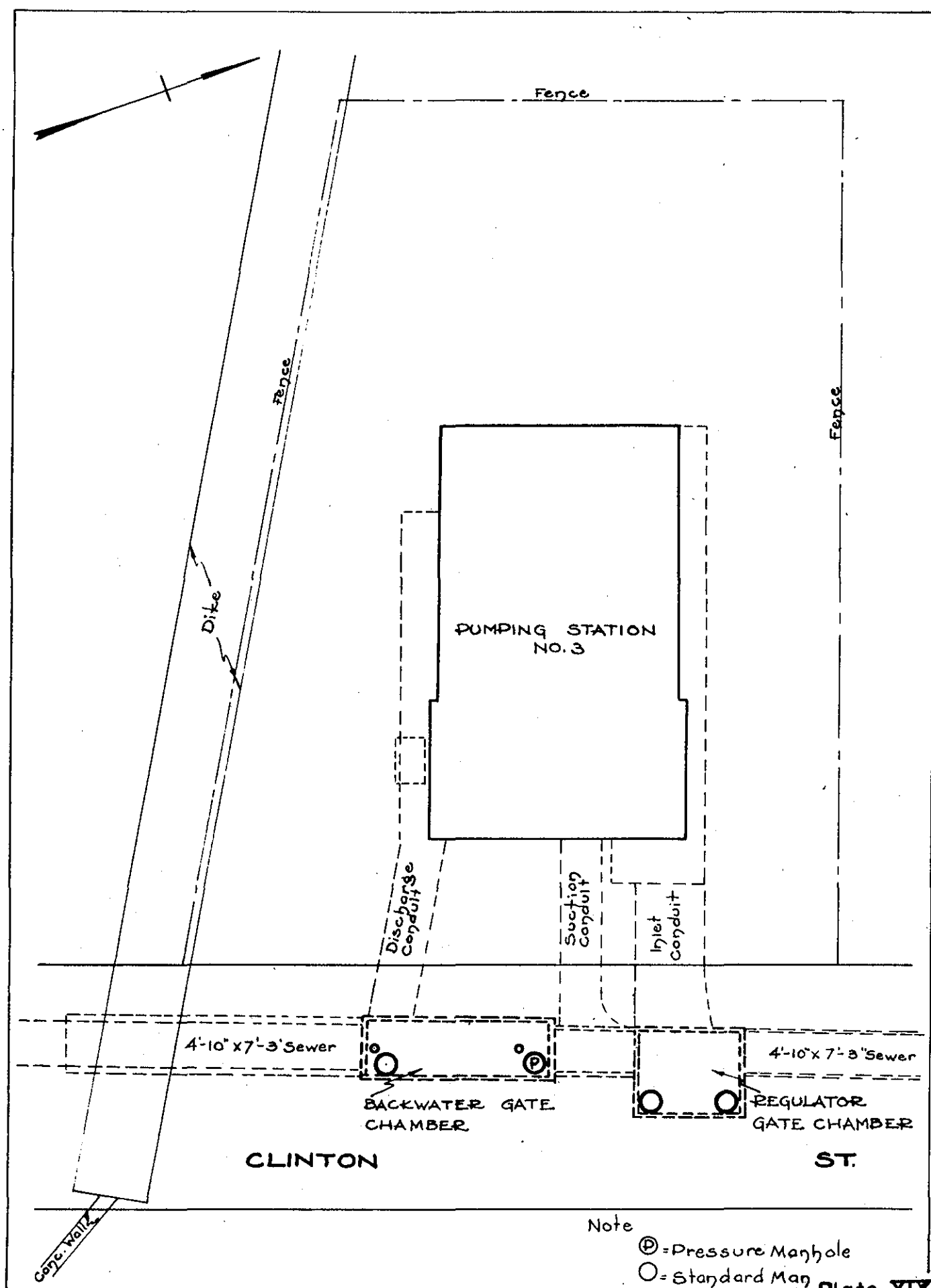
Note

⊙ = Pressure Manhole

○ = Standard Manhole





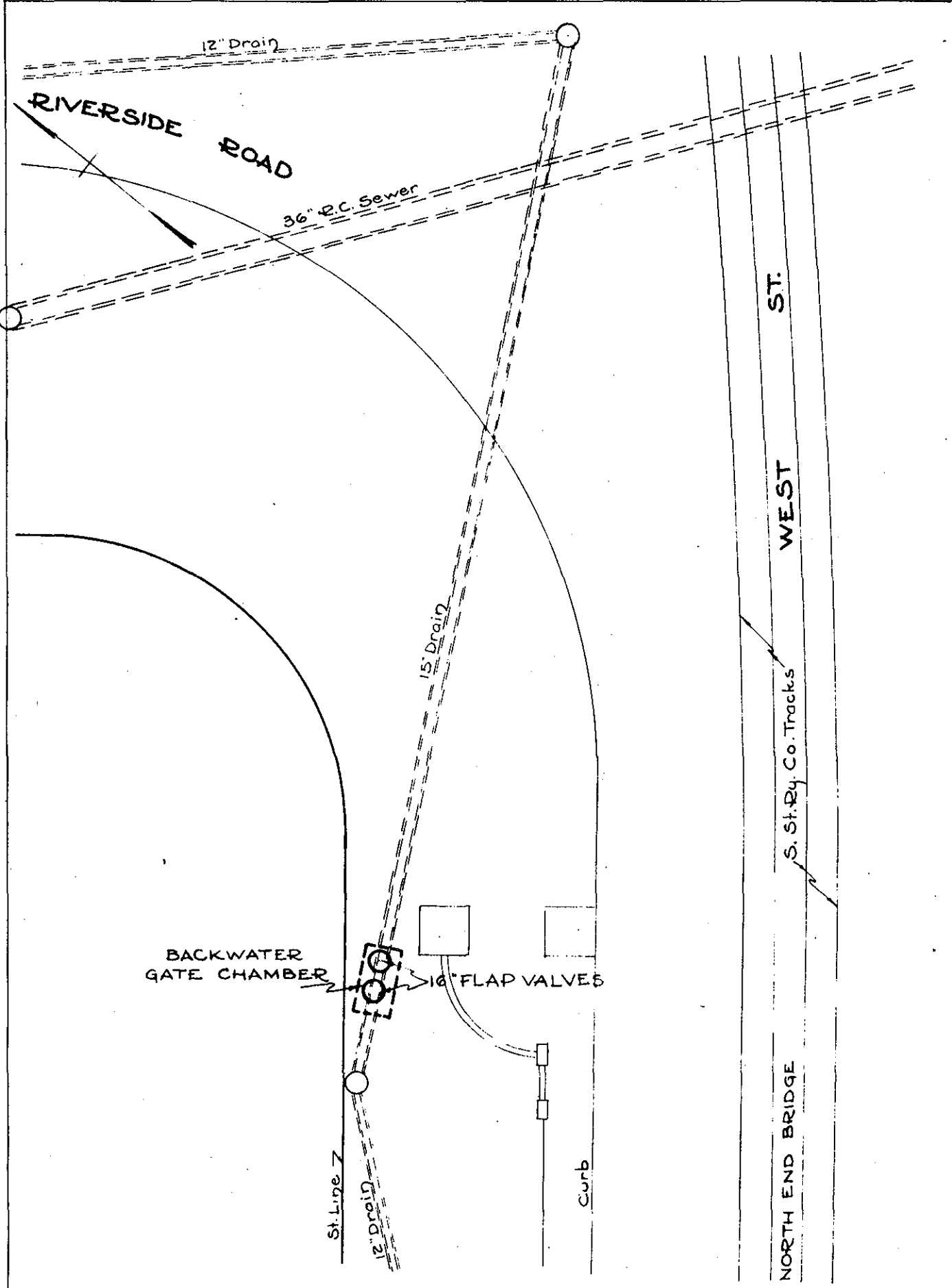


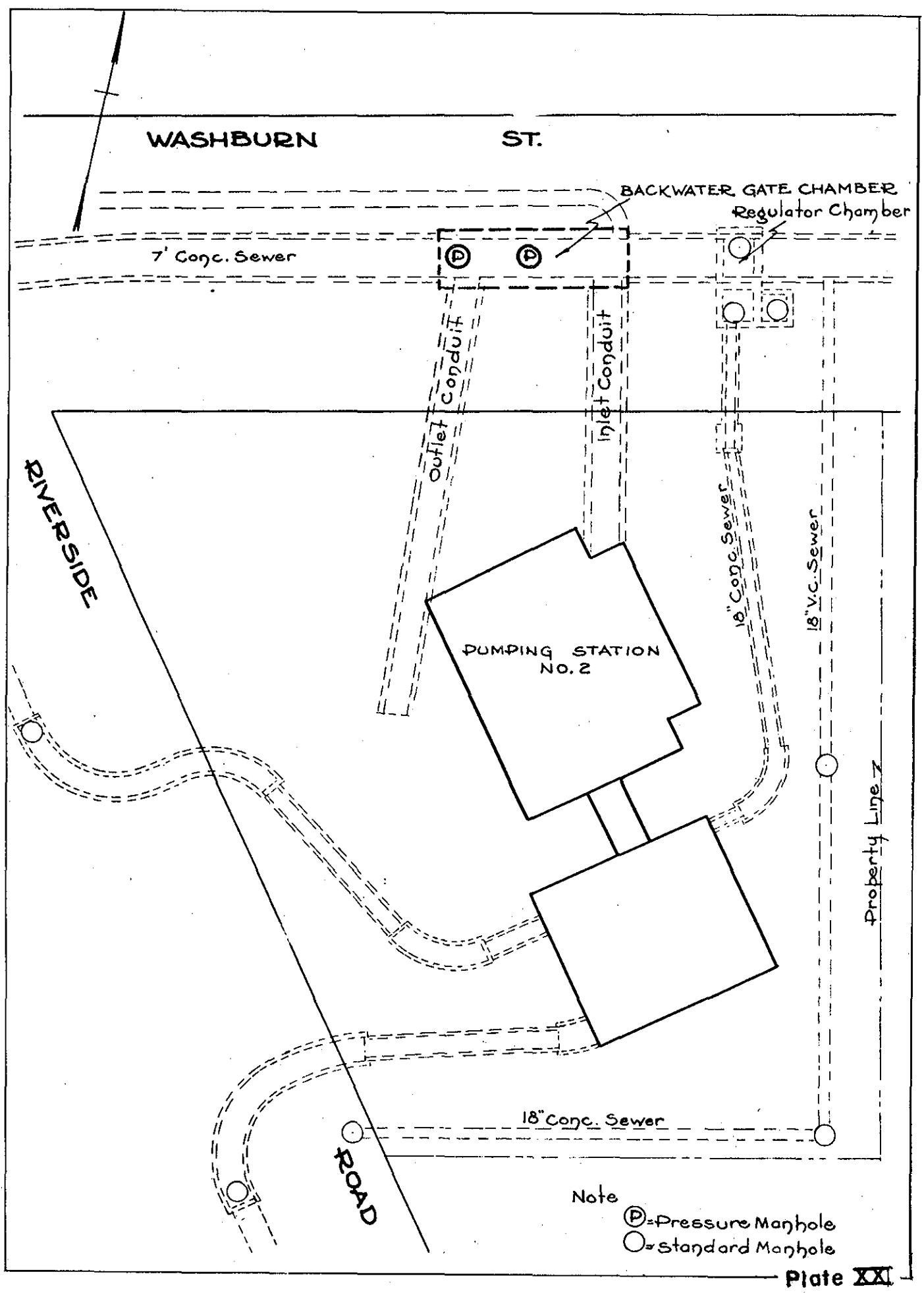
Note

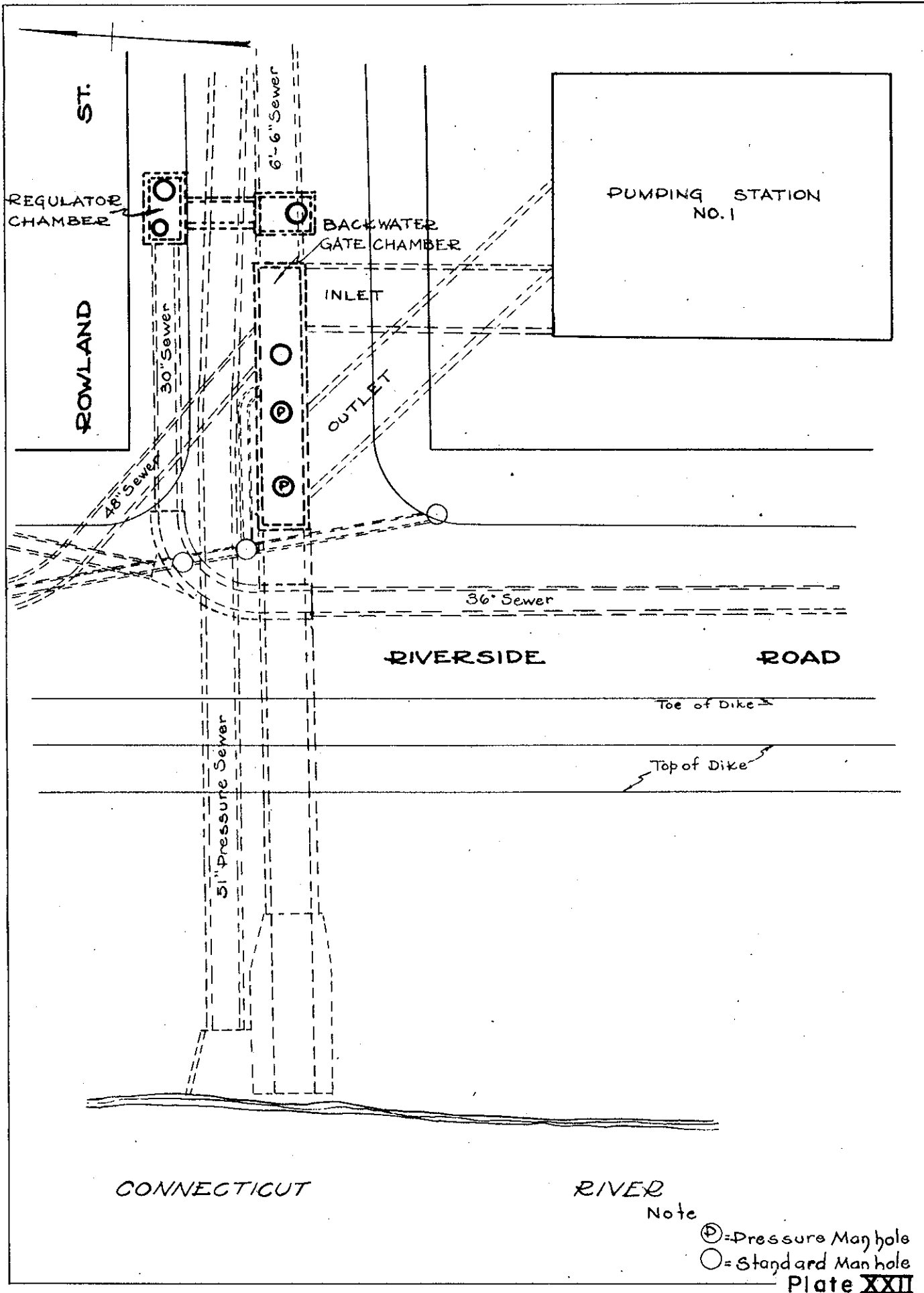
Ⓟ = Pressure Manhole

○ = Standard Man

Plate XIX



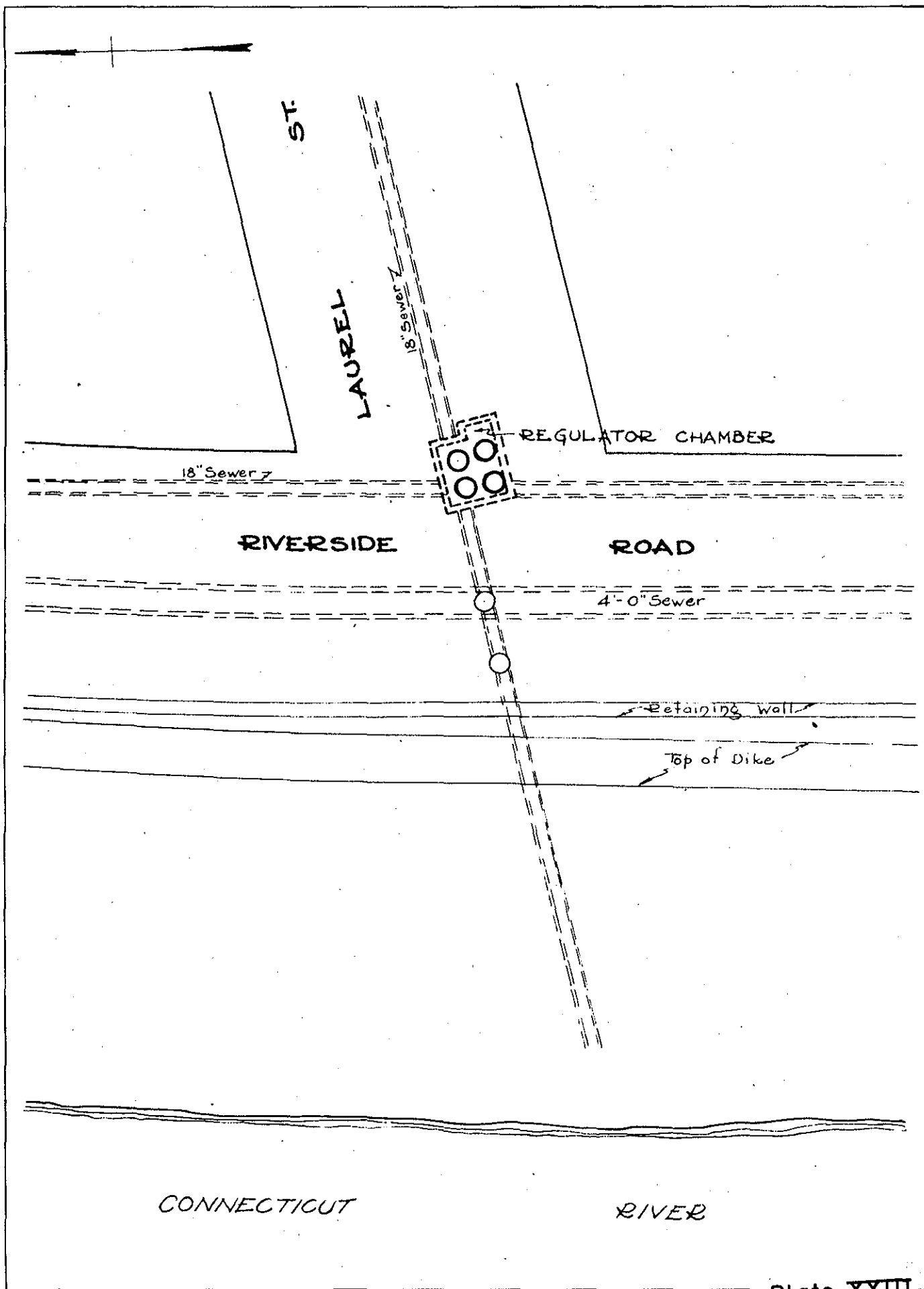


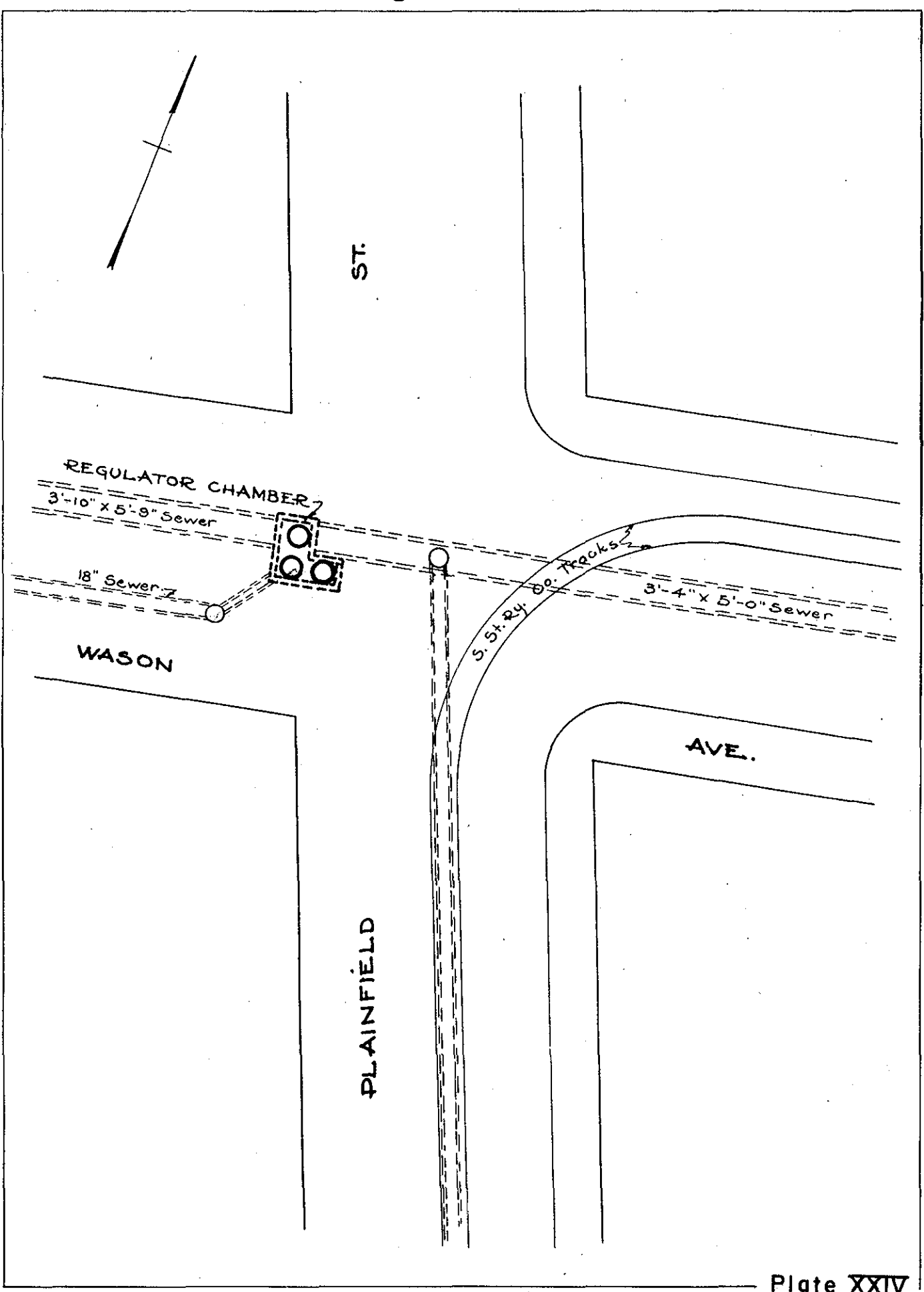


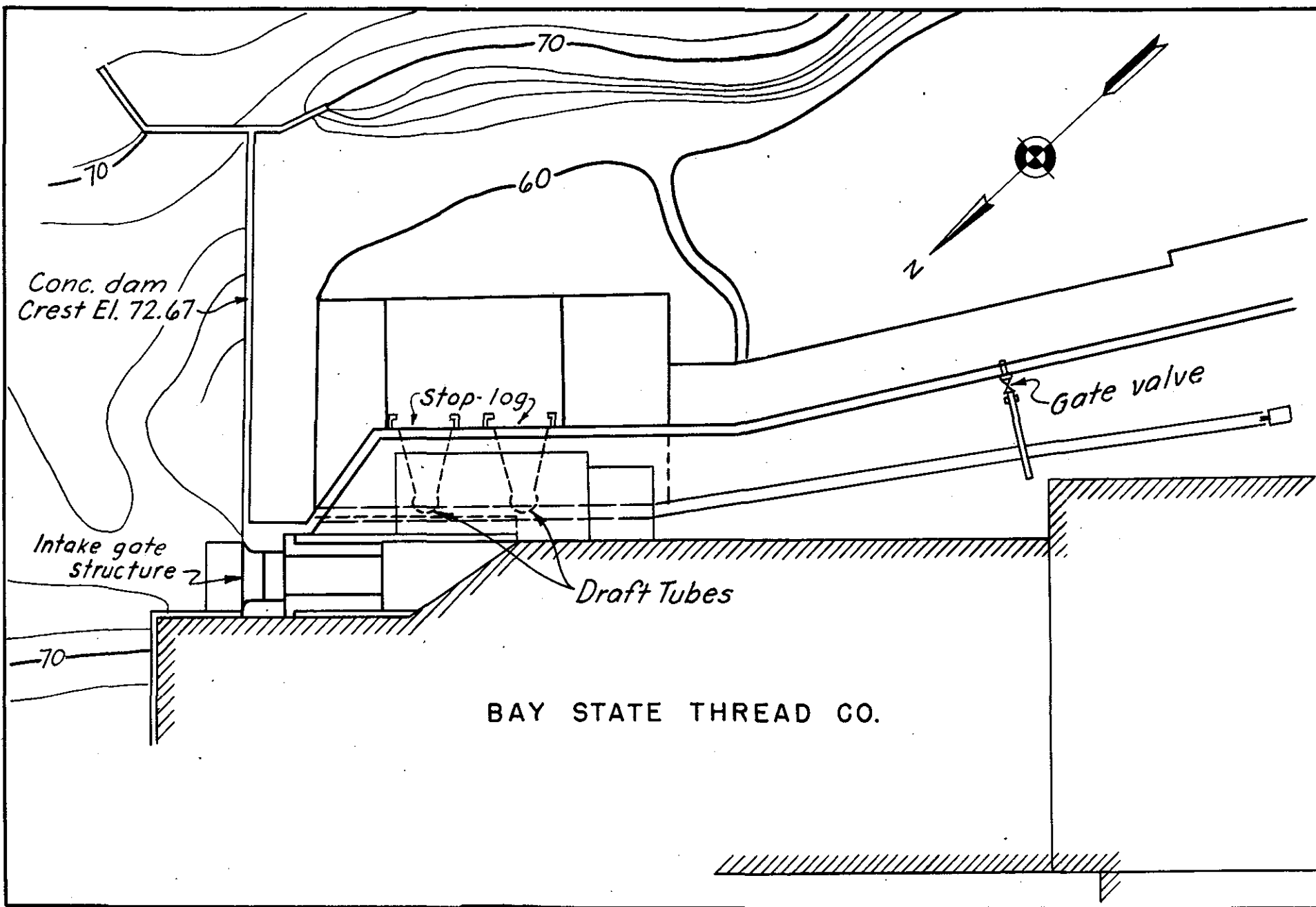
Note

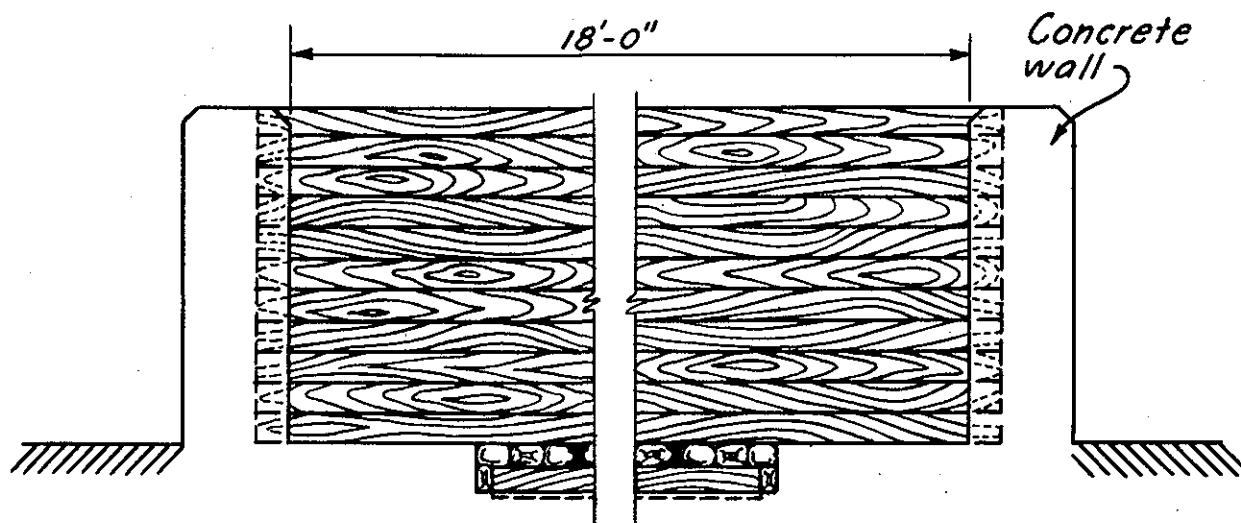
- Ⓟ = Pressure Man hole
- = Standard Man hole



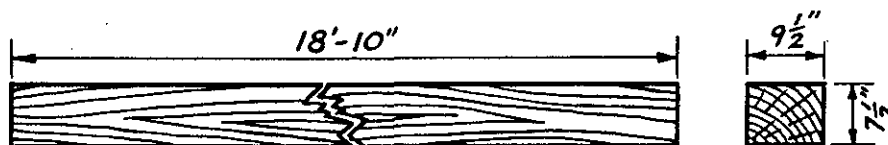




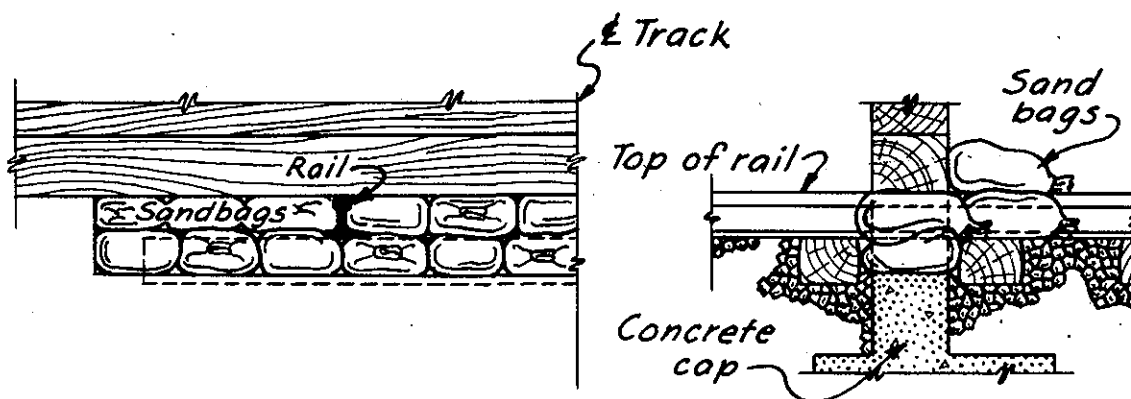




**ELEVATION VIEW R.R. STOP-LOG CLOSURE**

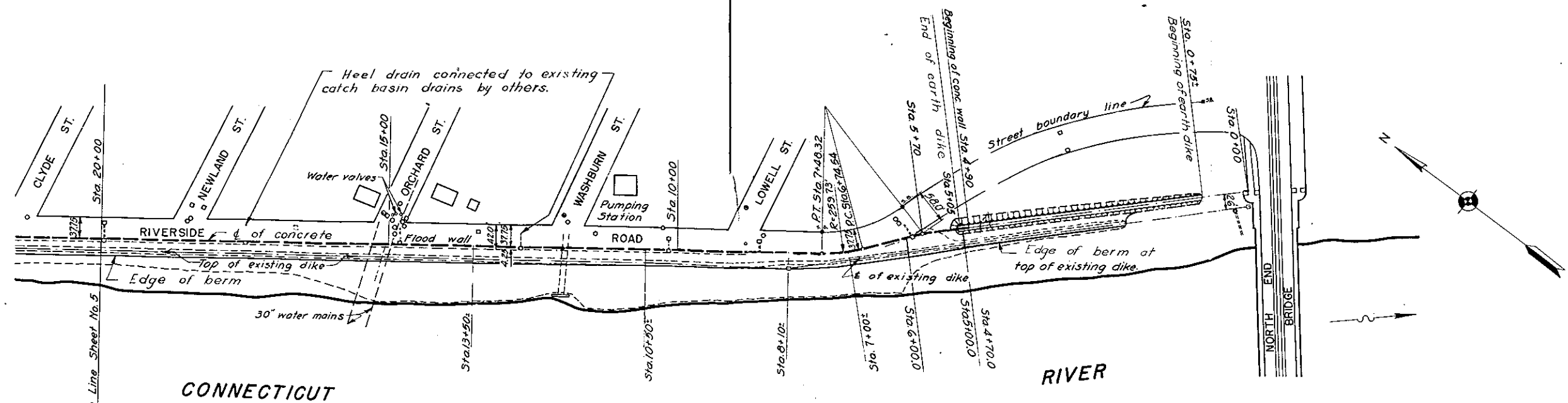


**DETAIL OF STOP-LOG**



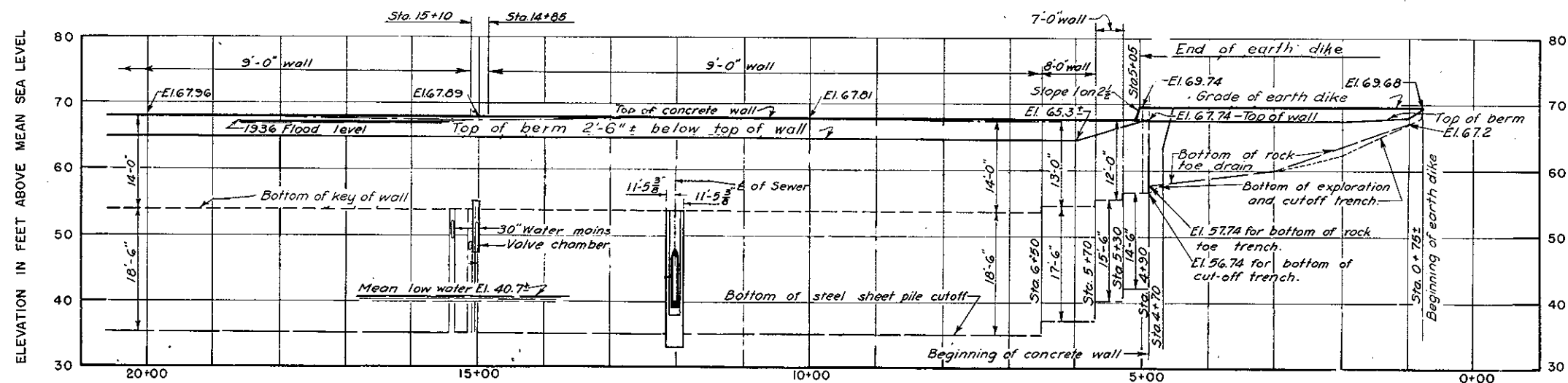
**DETAIL OF STOP LOG CLOSURE**

**Note:** Wedge top timbers in place to prevent floating. Canvas or sisal craft paper should be tacked on river side face of Timbers after erection to prevent excessive leakage.



PLAN

SCALE 1"=100'



PROFILE

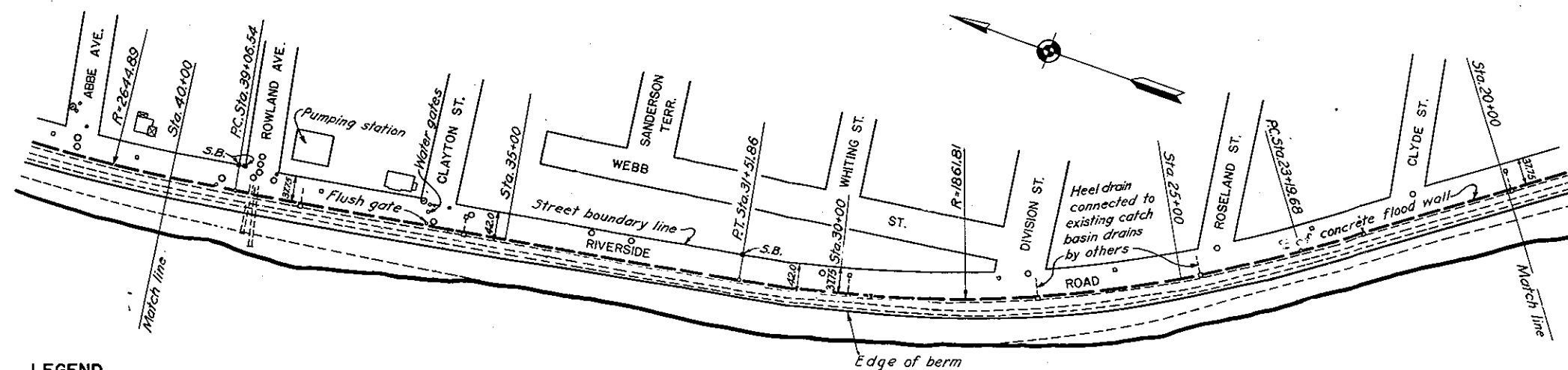
SCALE: HORIZ. 1"=100'  
VERT. 1"=10'

## LEGEND

- Manhole.....
- Hydrant.....
- Stone Bound.....
- Catch Basin.....
- Shut Off.....
- Pole.....

NOTES:  
Elevations refer to Mean Sea Level Datum.  
For further details see contract drawings furnished City.

CONNECTICUT RIVER FLOOD CONTROL  
SPRINGFIELD DIKE  
NORTH END BRIDGE TO CHICOPEE TOWN LINE  
GENERAL PLAN NO. 1  
SPRINGFIELD, MASS.  
CONNECTICUT RIVER MASSACHUSETTS  
SCALE 1 IN. = 100 FT.  
U.S. ENGINEER OFFICE, PROVIDENCE R.I.,  
OPERATION AND MAINTENANCE MANUAL  
SPRINGFIELD, MASS.



## LEGEND

- MANHOLE ○
- HYDRANT ●
- STONE BOUND . . . S.B.
- CATCH BASIN ○
- SHUTOFF ○
- POLE .

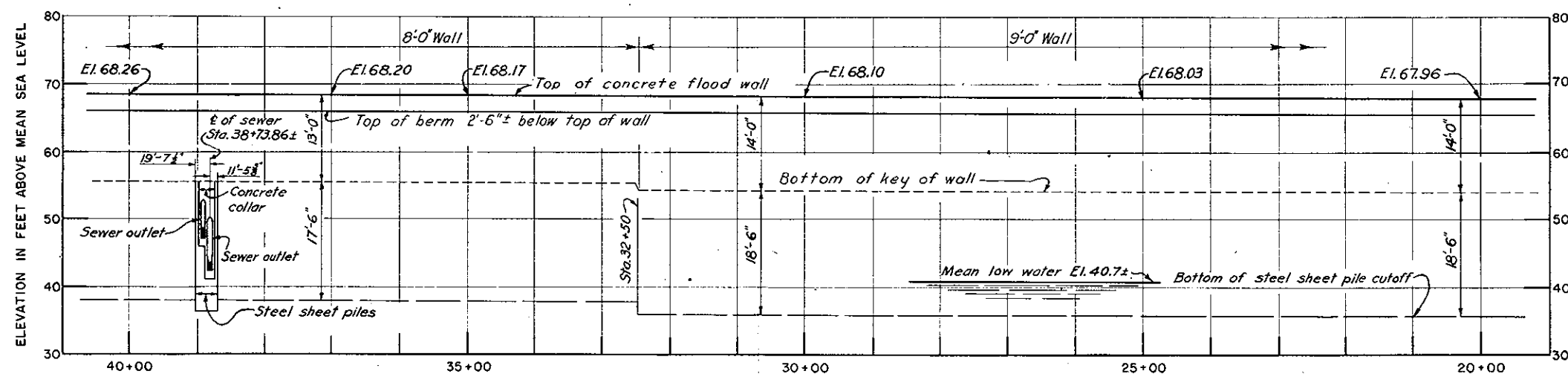
CONNECTICUT

## PLAN

SCALE 1" = 100'

100' 0' 100' 200'

RIVER



## PROFILE

SCALE: HORIZ. 1" = 100'

VERT. 1" = 10'

## NOTES:

Elevations refer to Mean Sea Level Datum.  
For further details see contract drawings  
furnished City.

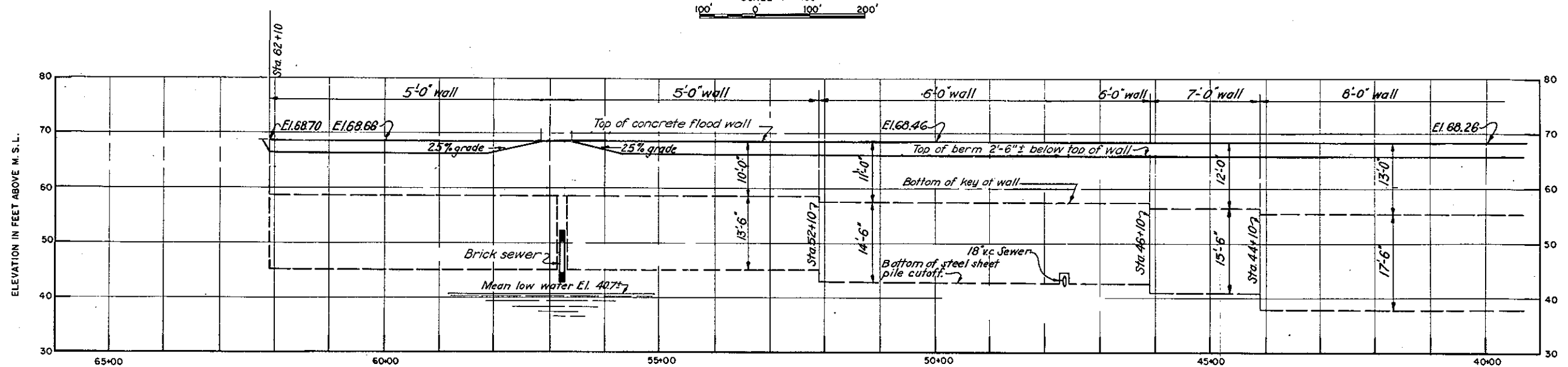
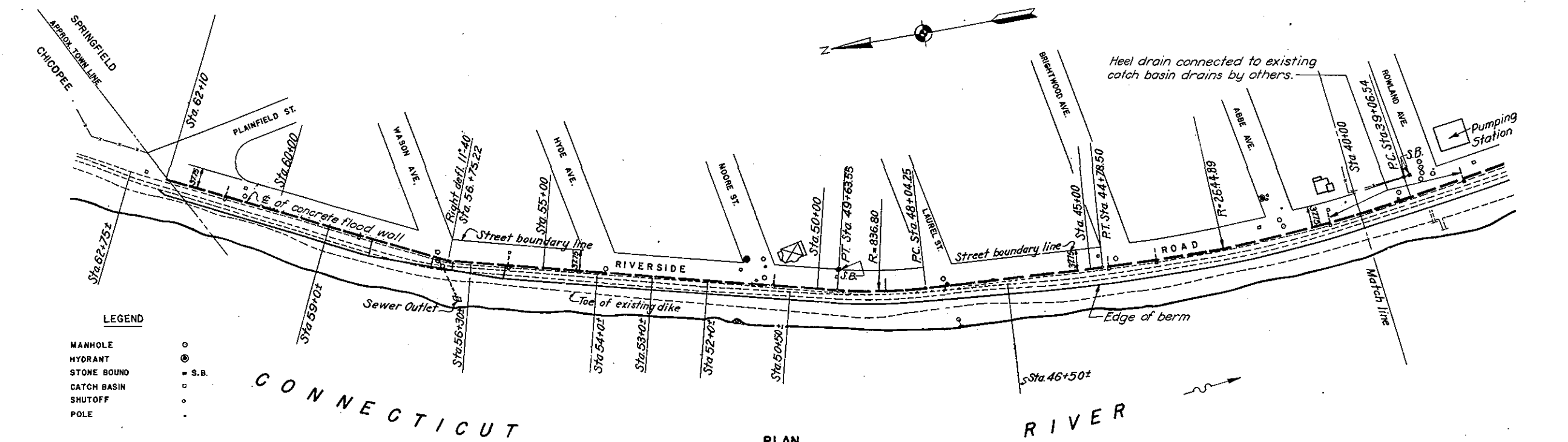
CONNECTICUT RIVER FLOOD CONTROL  
**SPRINGFIELD DIKE**  
NORTH END BRIDGE TO CHICOPEE TOWN LINE  
GENERAL PLAN NO. 2  
SPRINGFIELD, MASS.

CONNECTICUT RIVER MASSACHUSETTS

SCALE 1 IN. = 100 FT.

U.S. ENGINEER OFFICE, PROVIDENCE, R.I.

**OPERATION AND MAINTENANCE MANUAL**  
SPRINGFIELD, MASS.



**NOTES:**  
Elevations refer to Mean Sea Level Datum.  
For further details see contract drawings  
furnished City.

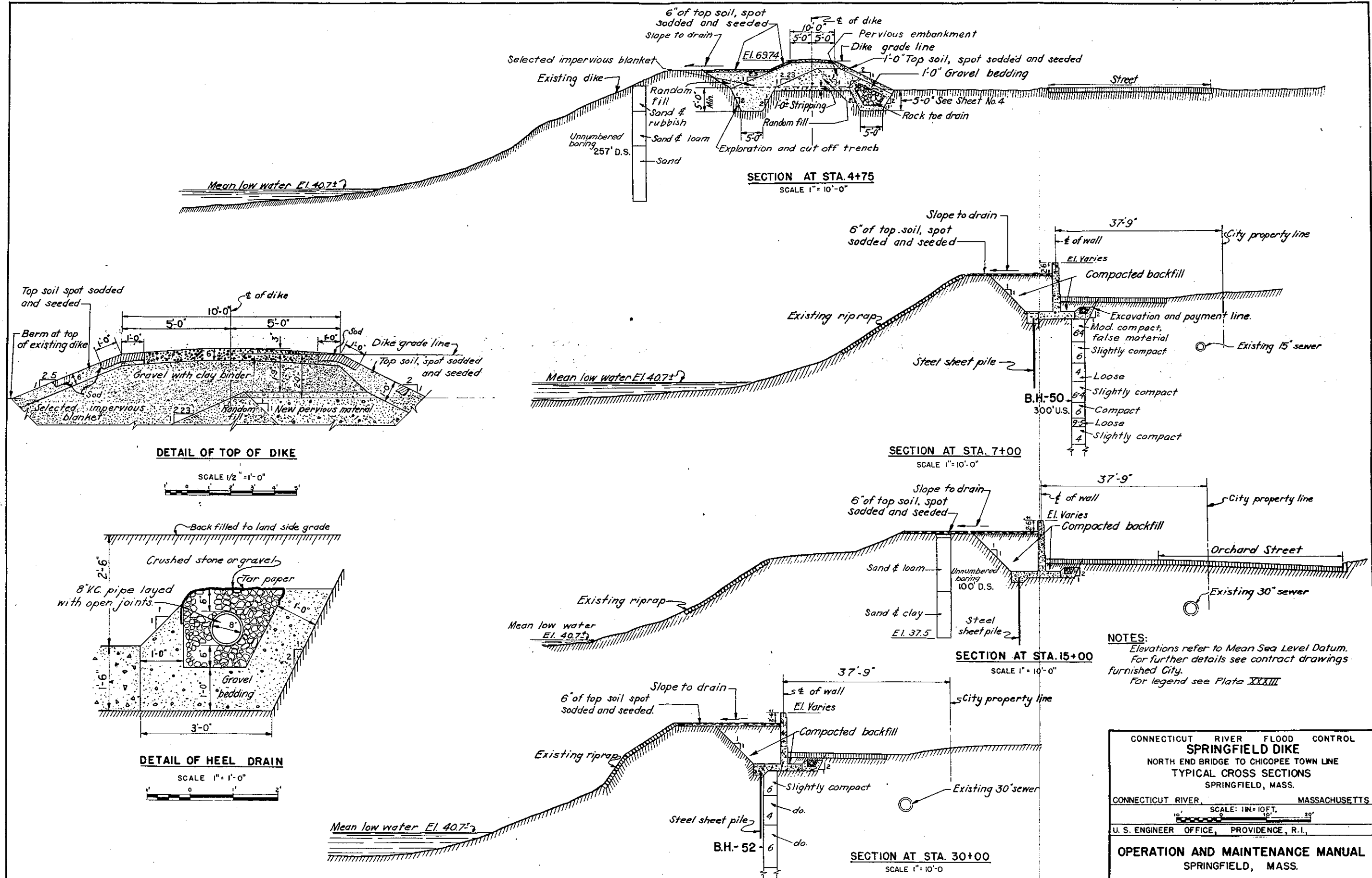
CONNECTICUT RIVER FLOOD CONTROL  
**SPRINGFIELD DIKE**  
NORTH END BRIDGE TO CHICOPEE TOWN LINE  
GENERAL PLAN NO. 3  
SPRINGFIELD, MASS.

CONNECTICUT RIVER, MASSACHUSETTS

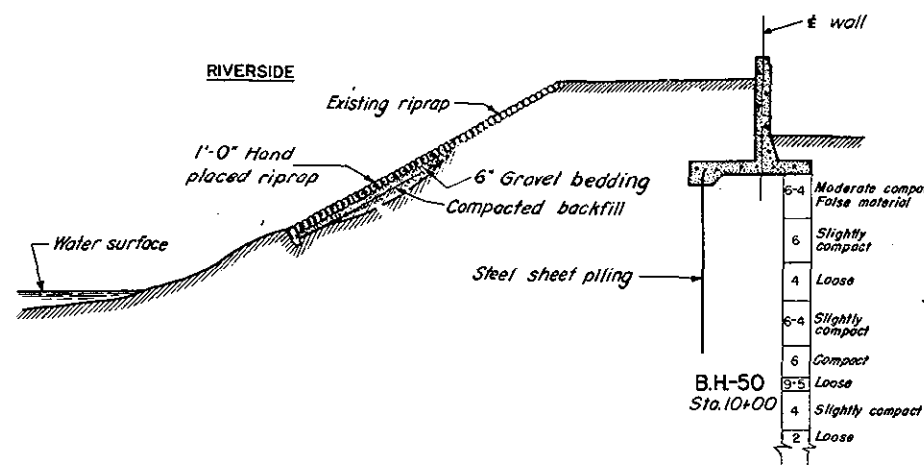
SCALE: 1" = 100'

U.S. ENGINEER OFFICE, PROVIDENCE, R.I.

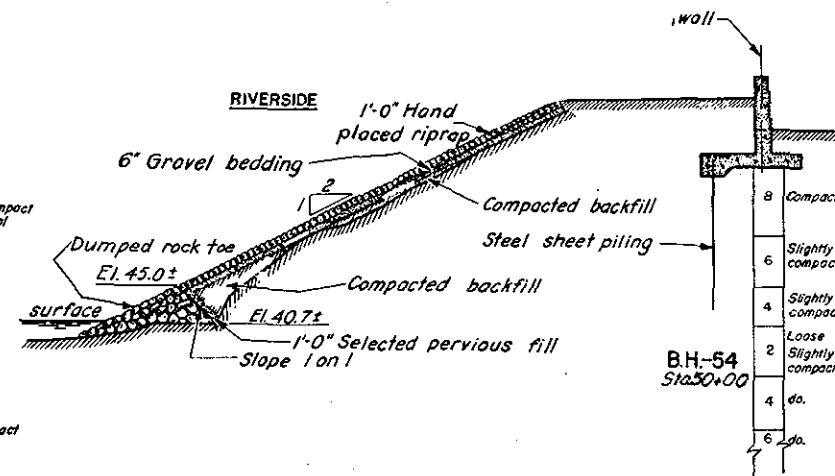
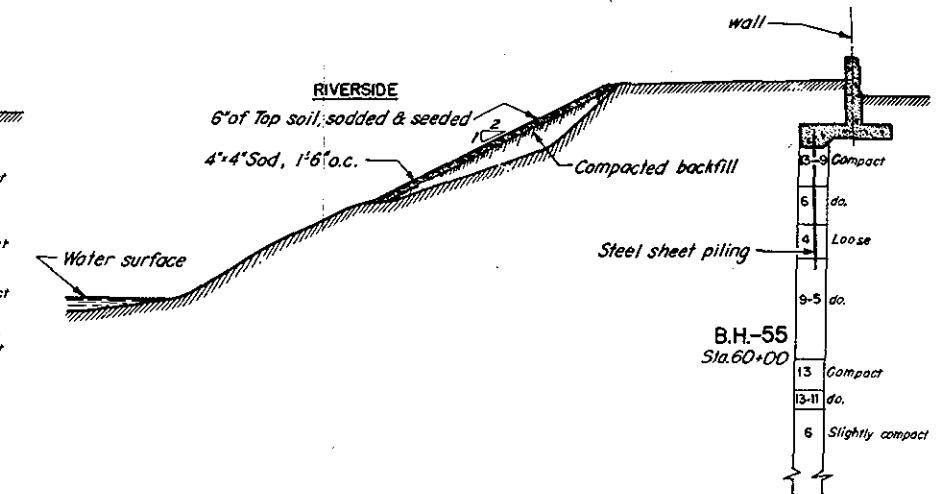
**OPERATION AND MAINTENANCE MANUAL**  
SPRINGFIELD, MASS.



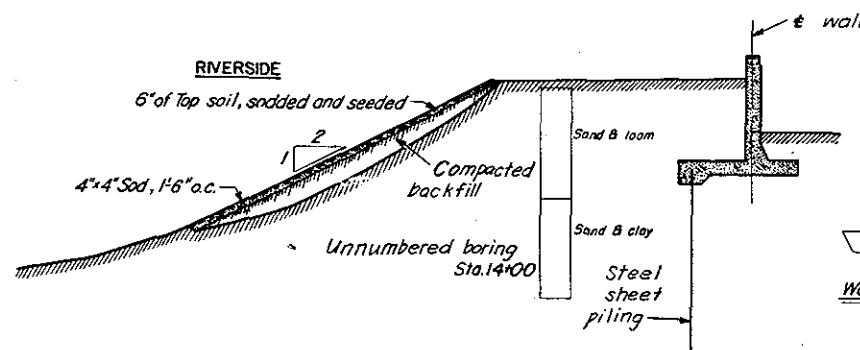




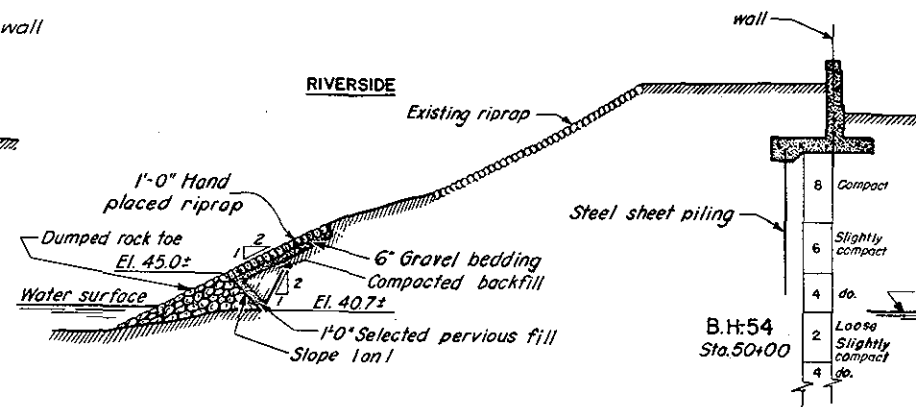
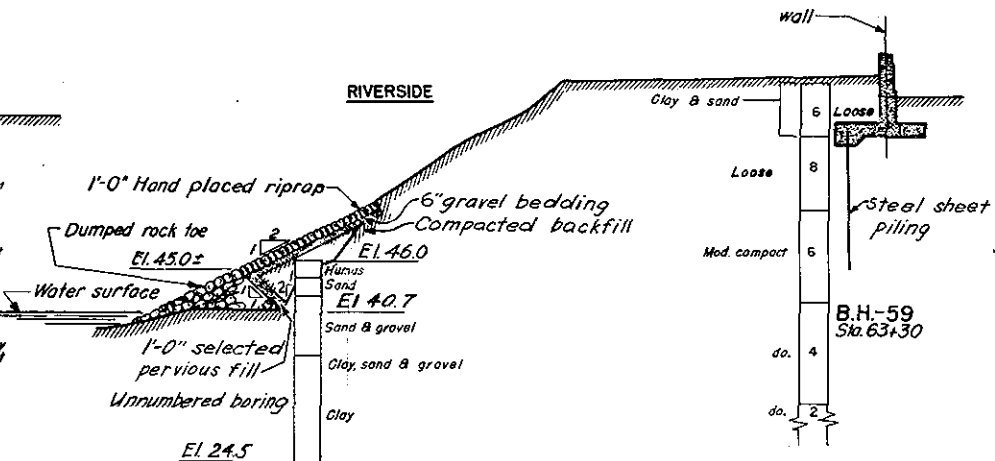
TYPICAL TREATMENT BETWEEN STA. 7+00± AND STA. 8+00±

TYPICAL TREATMENT BETWEEN  
STA. 48+25± AND STA. 49+10±

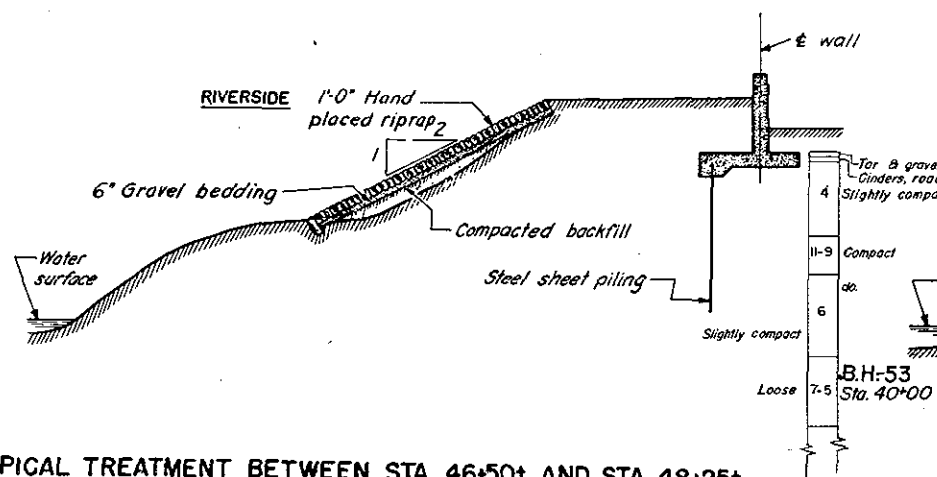
TYPICAL TREATMENT BETWEEN STA. 54+00± AND STA. 56+30±



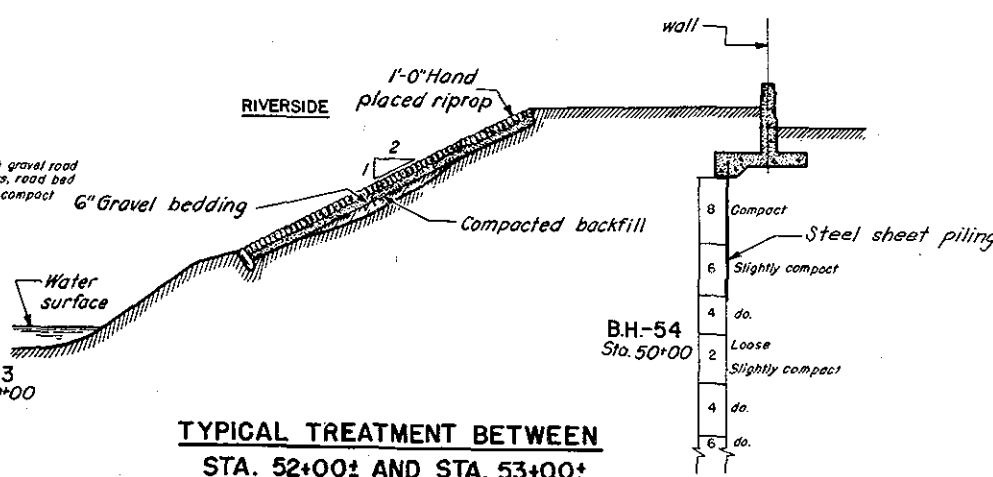
TYPICAL TREATMENT BETWEEN STA. 10+50± AND STA. 13+50±

TYPICAL TREATMENT BETWEEN  
STA. 49+10± AND STA. 50+50±

TYPICAL TREATMENT BETWEEN STA. 59+00± AND STA. 62+75±



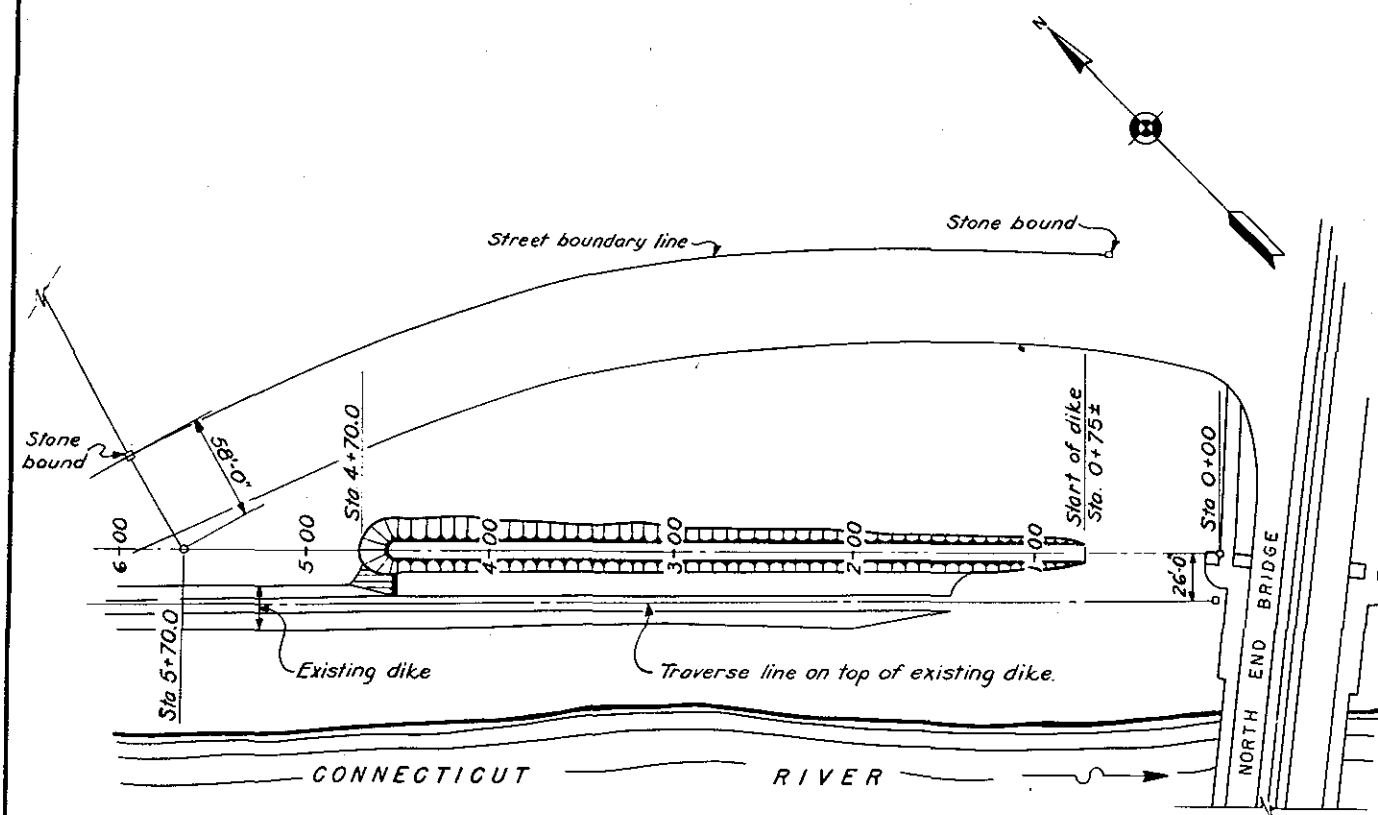
TYPICAL TREATMENT BETWEEN STA. 46+50± AND STA. 48+25±

TYPICAL TREATMENT BETWEEN  
STA. 52+00± AND STA. 53+00±

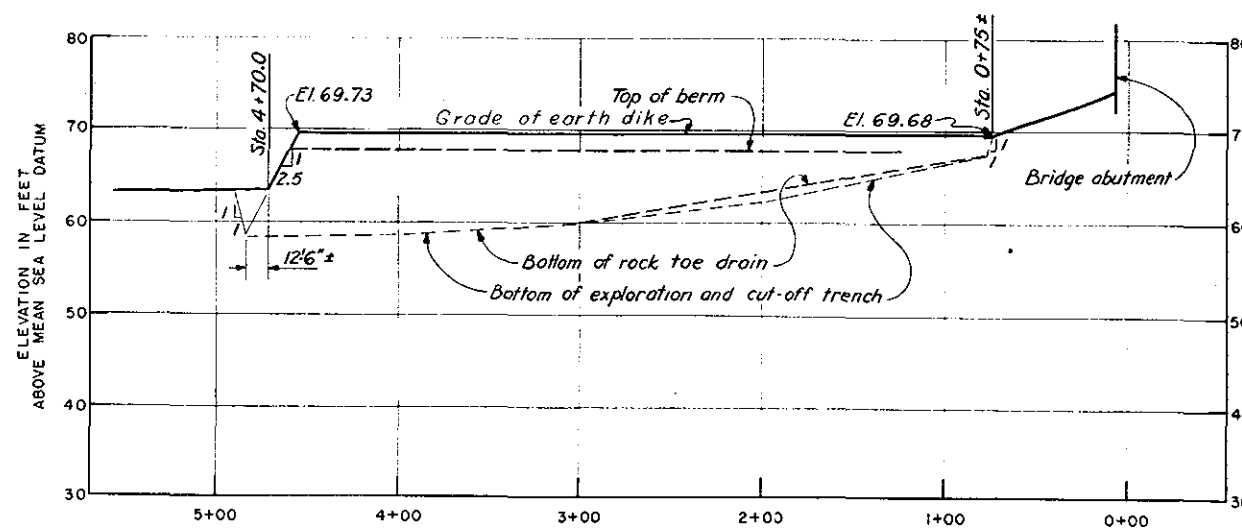
## NOTES:

Elevations refer to Mean Sea Level Datum.  
For further details see contract drawings  
furnished City.  
For legend see Plate XXXIII

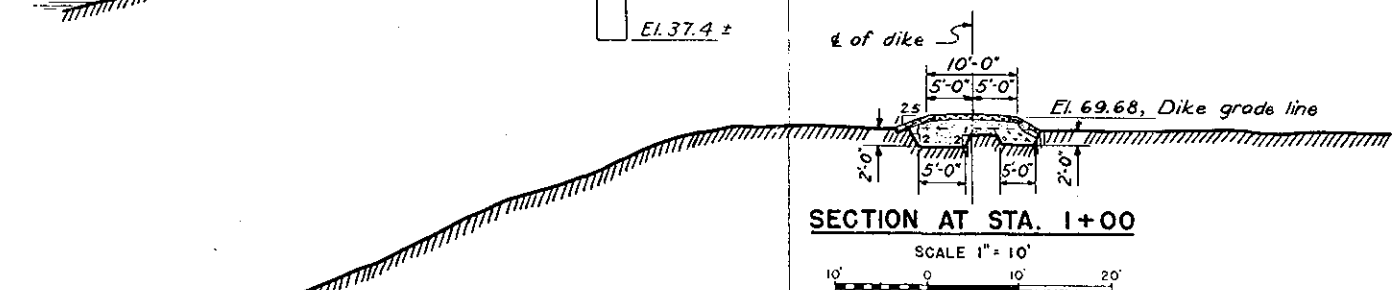
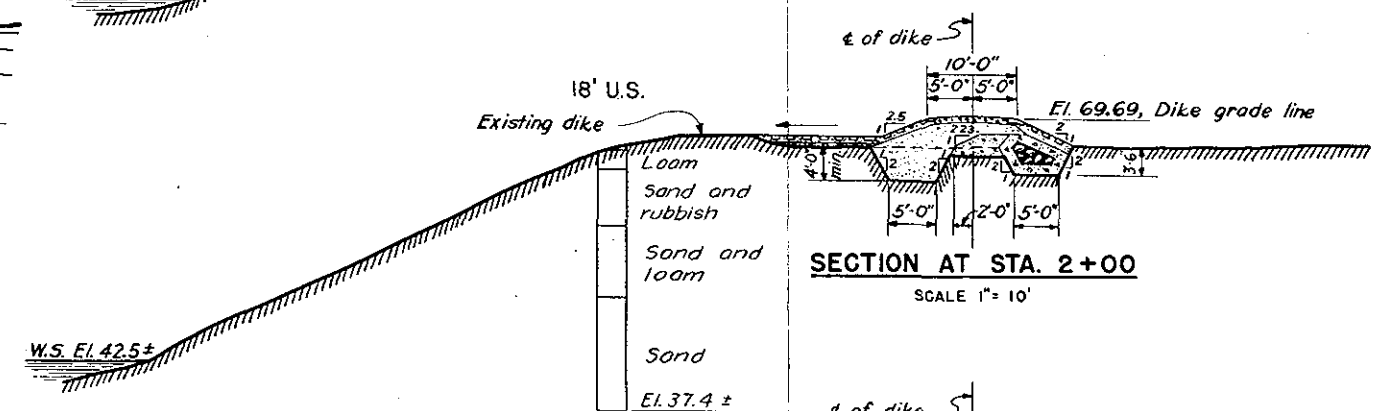
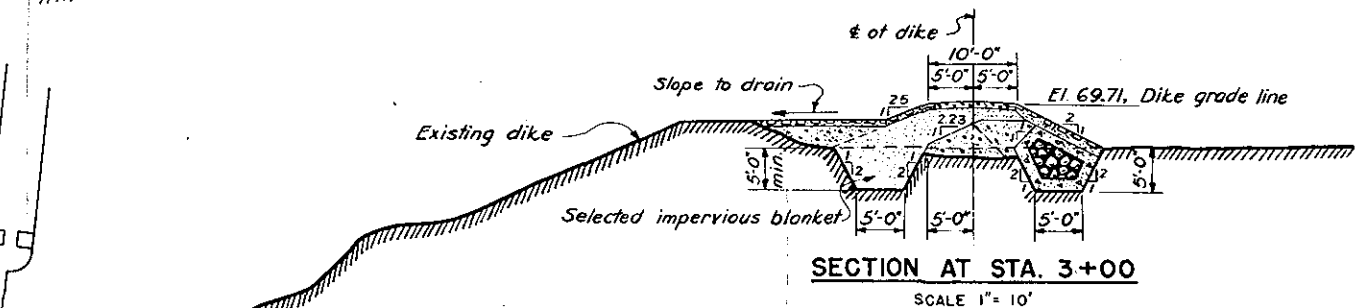
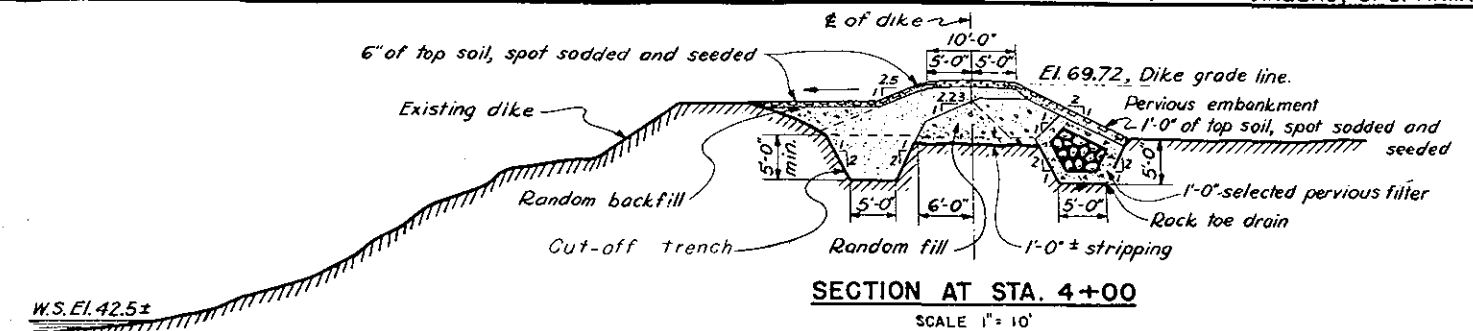
CONNECTICUT RIVER FLOOD CONTROL	
SPRINGFIELD DIKE	
NORTH END BRIDGE TO CHICOPEE TOWN LINE	
CROSS SECTIONS, RIVER BANK IMPROVEMENT	
SPRINGFIELD, MASS.	
CONNECTICUT RIVER	MASSACHUSETTS
SCALE 1 IN. = 10 FT.	
U.S. ENGINEER OFFICE, PROVIDENCE, R.I.	
OPERATION AND MAINTENANCE MANUAL	
SPRINGFIELD, MASS.	



**PLAN**  
SCALE 1" = 50'

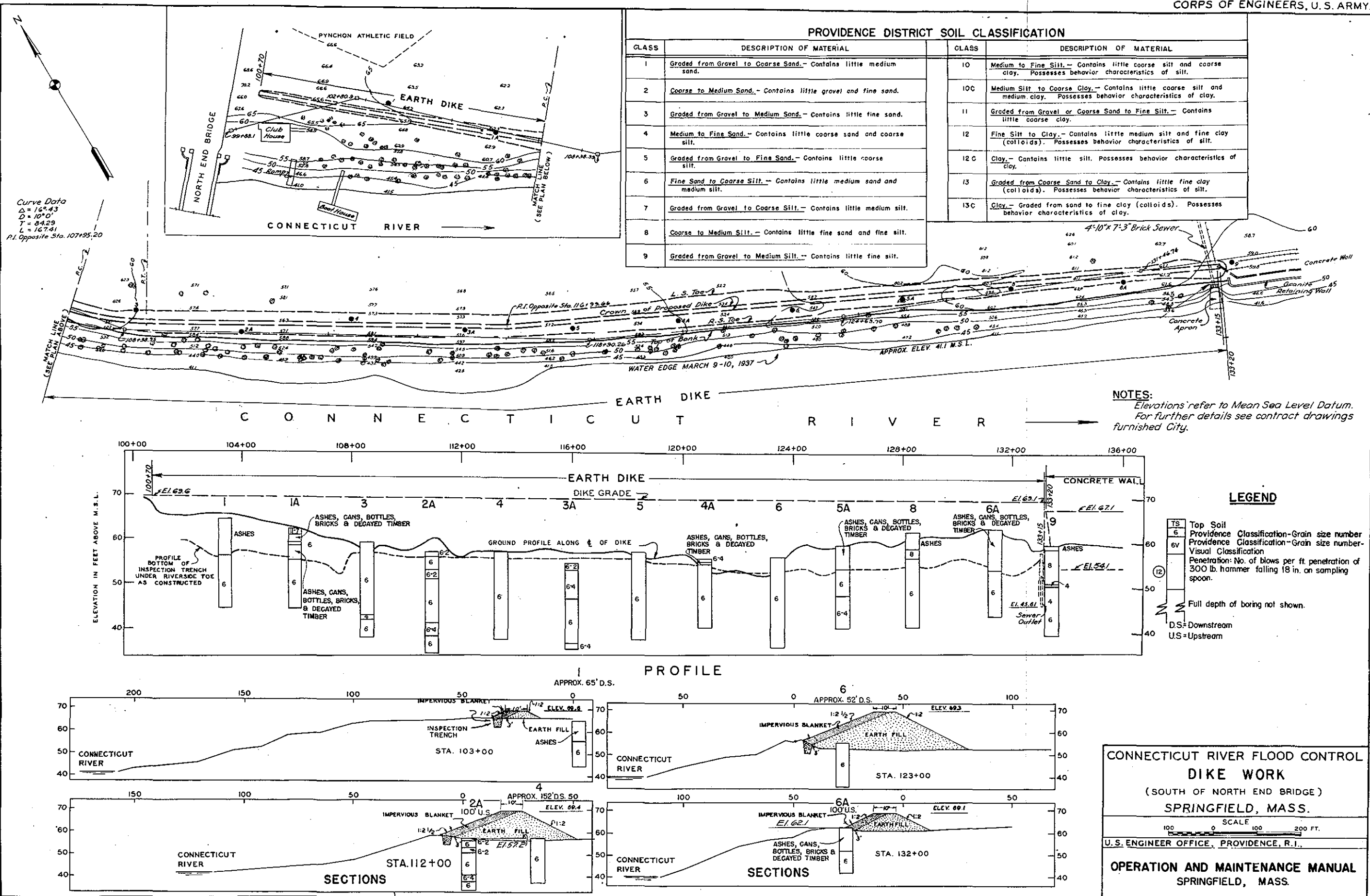


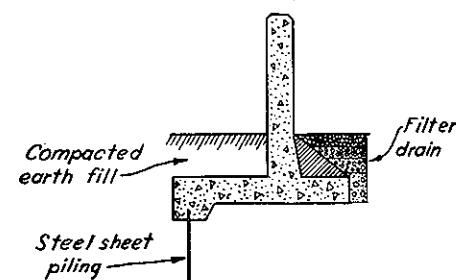
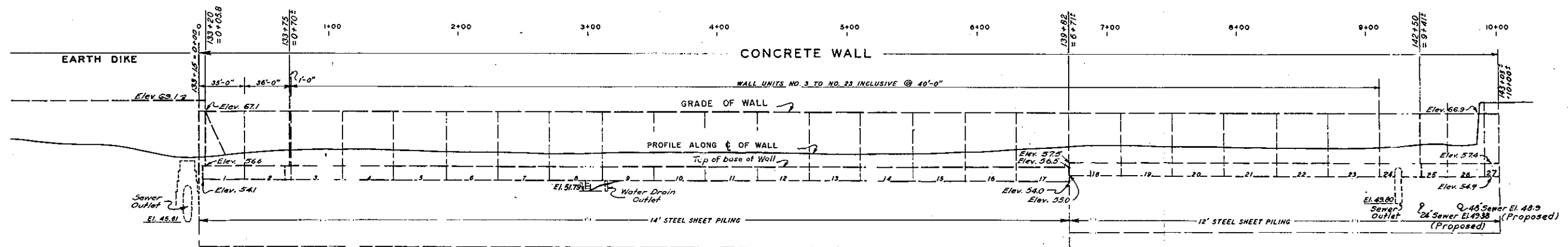
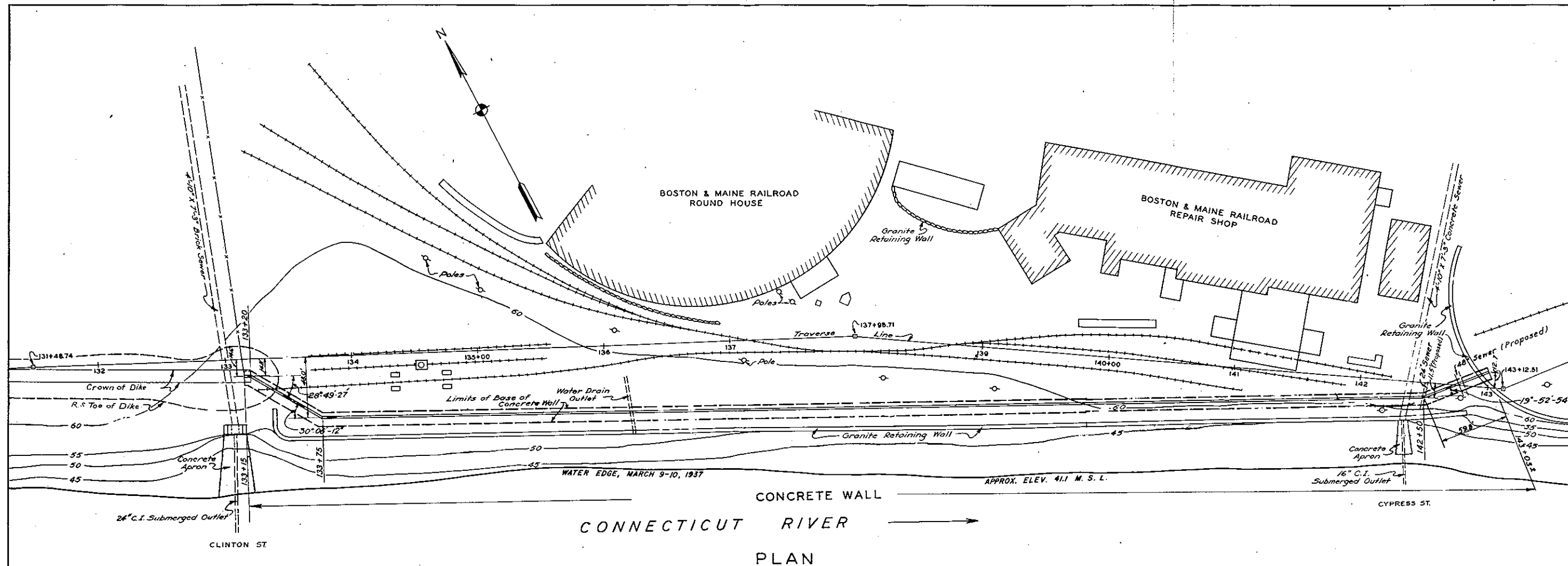
**PROFILE ALONG  $\frac{1}{2}$  OF DIKE**  
SCALE: HOR. 1" = 50'  
VERT. 1" = 10'



**NOTES**  
Elevations refer to Mean Sea Level Datum.  
For further details see contract drawings  
furnished City.  
For legend see Plate YX XIII.

CONNECTICUT RIVER FLOOD CONTROL  
**SPRINGFIELD DIKE**  
PLAN AND SECTIONS  
EARTH EMBANKMENT ABOVE NORTH END BRIDGE  
SPRINGFIELD, MASS.  
CONNECTICUT RIVER, MASSACHUSETTS  
SCALE 1 IN. = 50 FT.  
U.S. ENGINEER OFFICE, PROVIDENCE, R.I.  
**OPERATION AND MAINTENANCE MANUAL**  
SPRINGFIELD, MASS.





TYPICAL WALL SECTION

PROFILE

SCALE  
HOR. 1"=40'  
VERT. 1"=10'

NOTES:

Elevations refer to Mean Sea Level Datum.  
For further details see contract drawings  
furnished City.

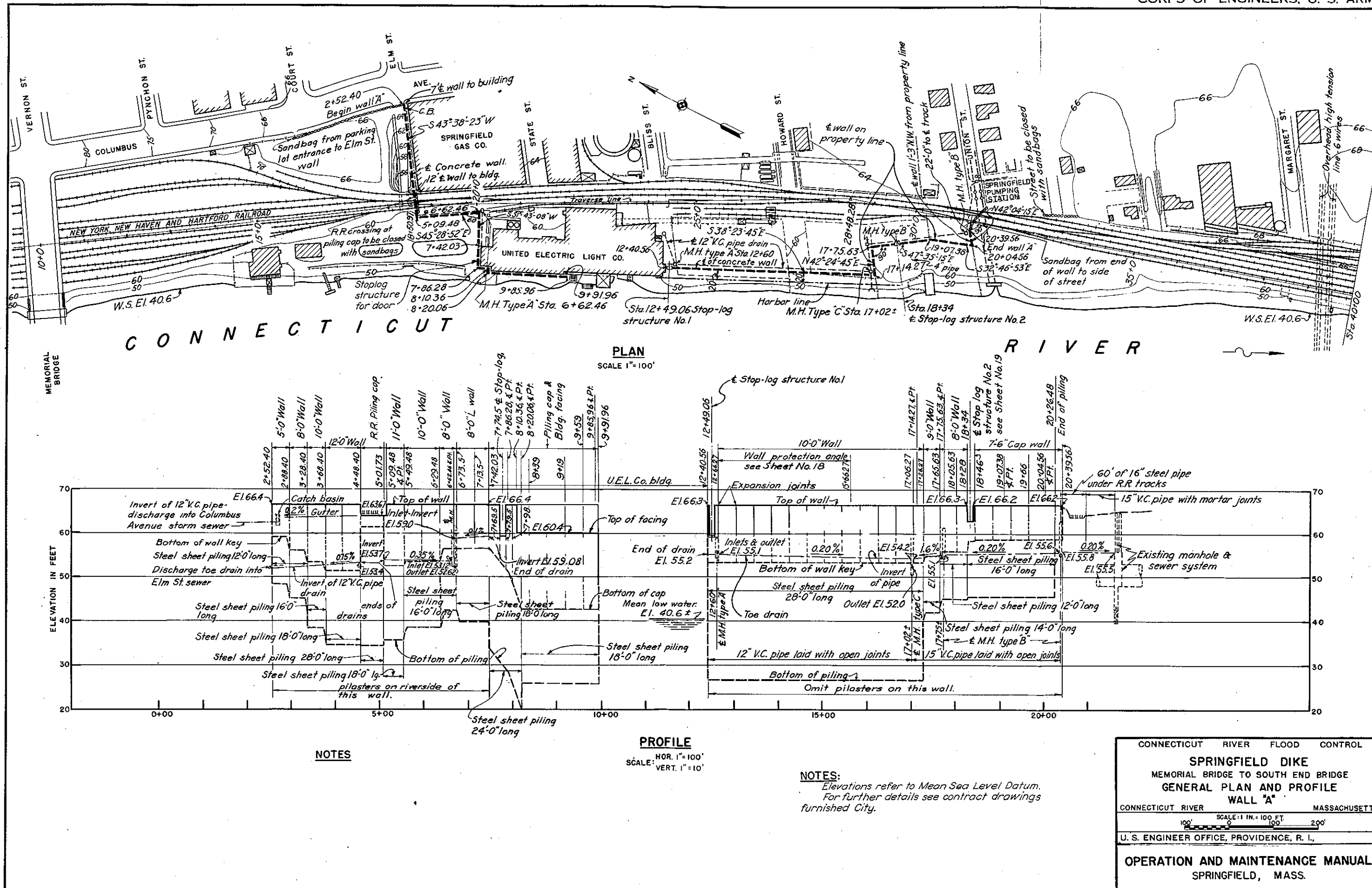
CONNECTICUT RIVER FLOOD CONTROL  
DIKE WORK

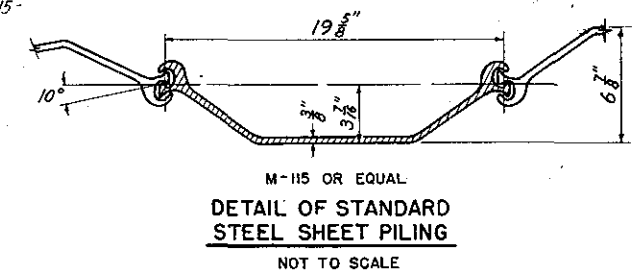
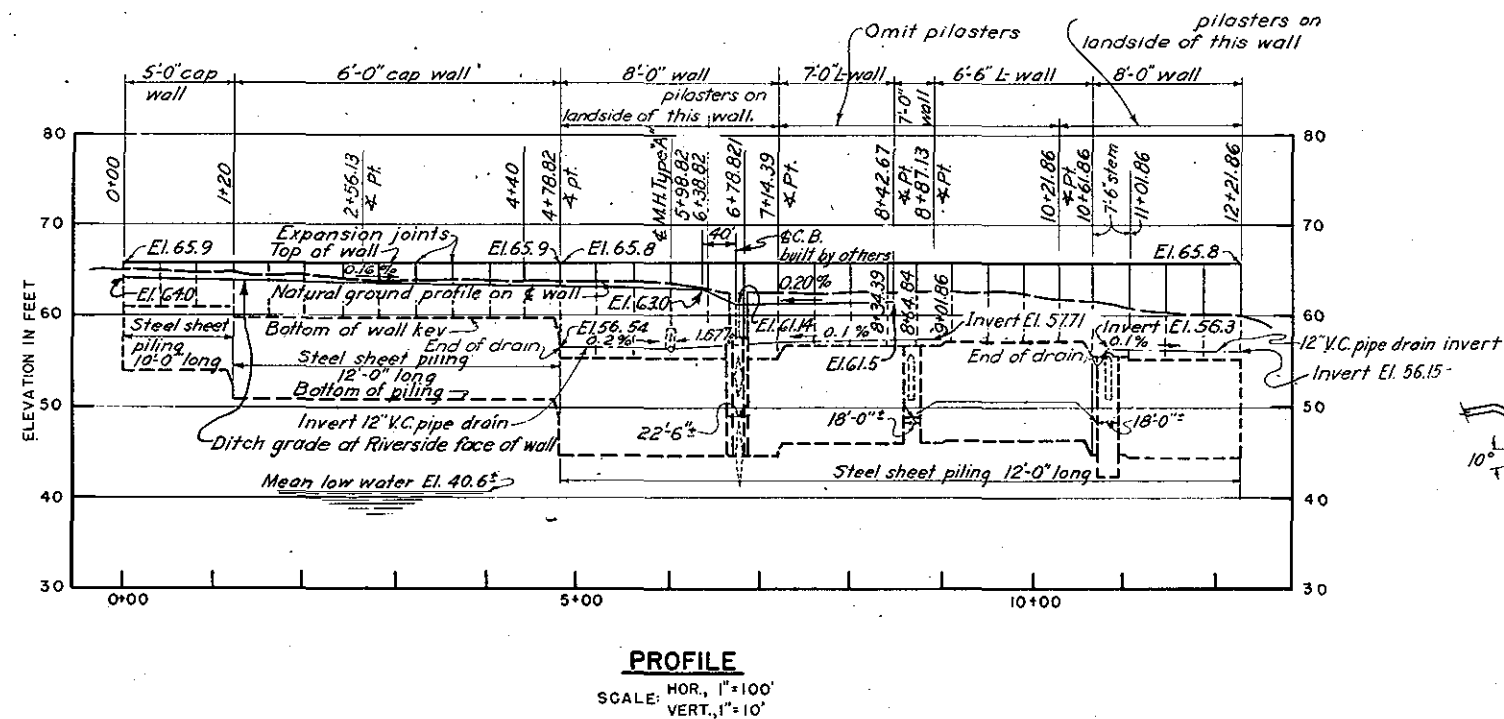
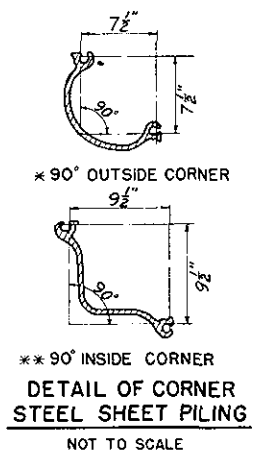
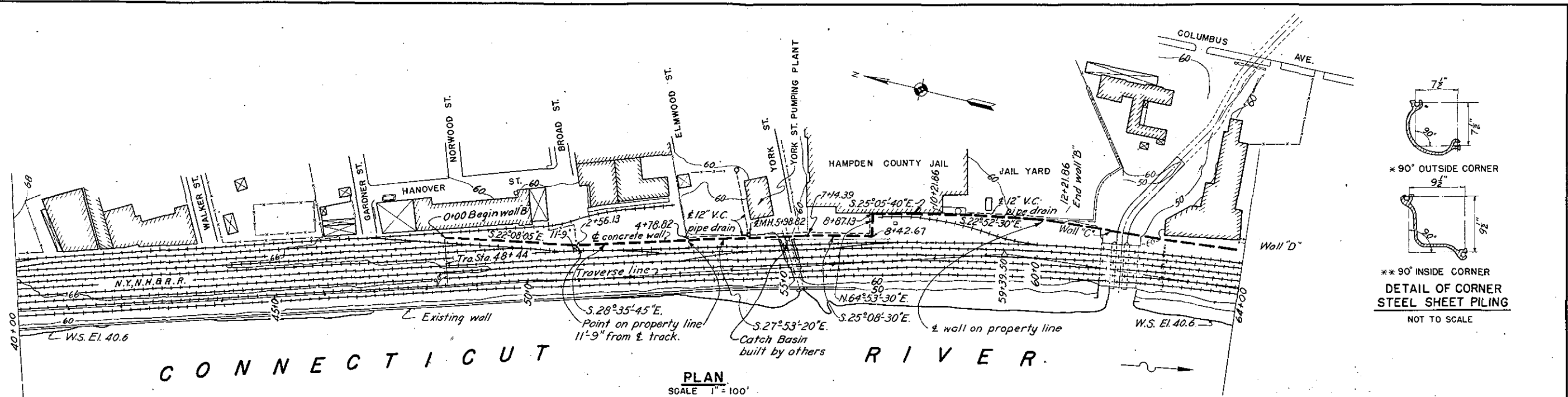
(SOUTH OF NORTH END BRIDGE)  
SPRINGFIELD, MASS.

SCALE  
40 20 0 40 80 FT.

U.S. ENGINEER OFFICE, PROVIDENCE, R.I.,

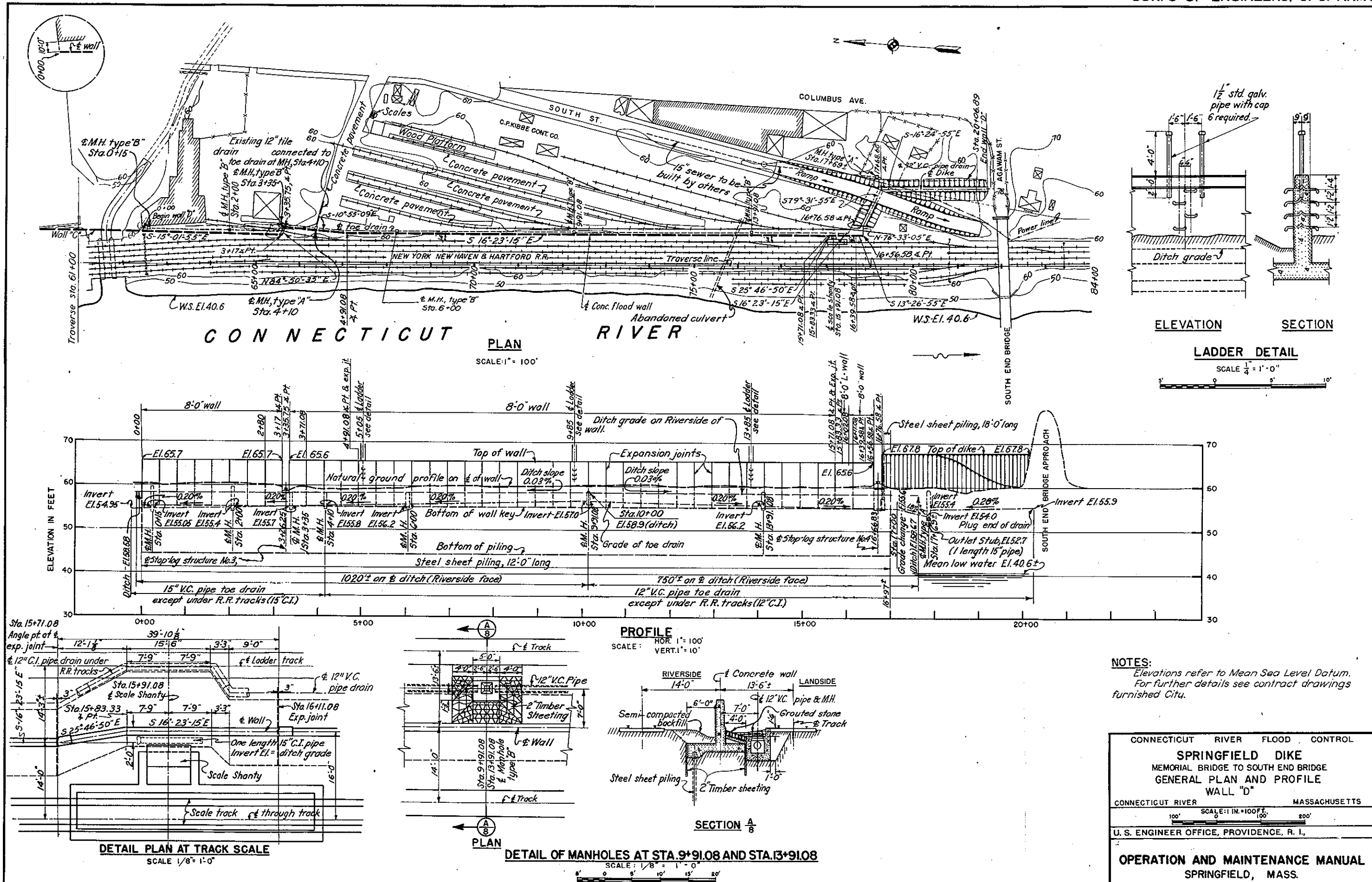
OPERATION AND MAINTENANCE MANUAL  
SPRINGFIELD, MASS.



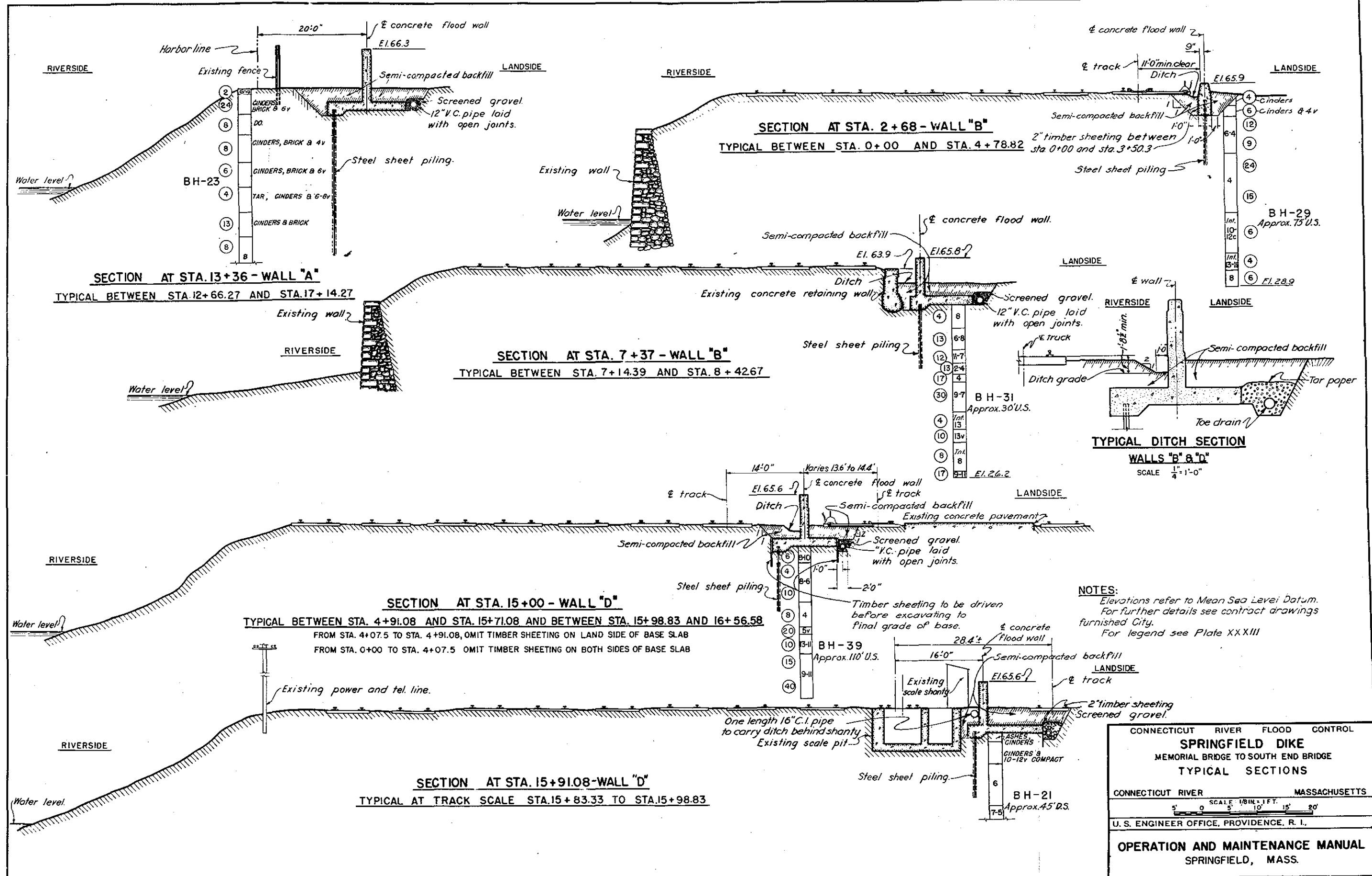


**NOTES:**  
Elevations refer to Mean Sea Level Datum.  
For further details see contract drawings  
furnished City.

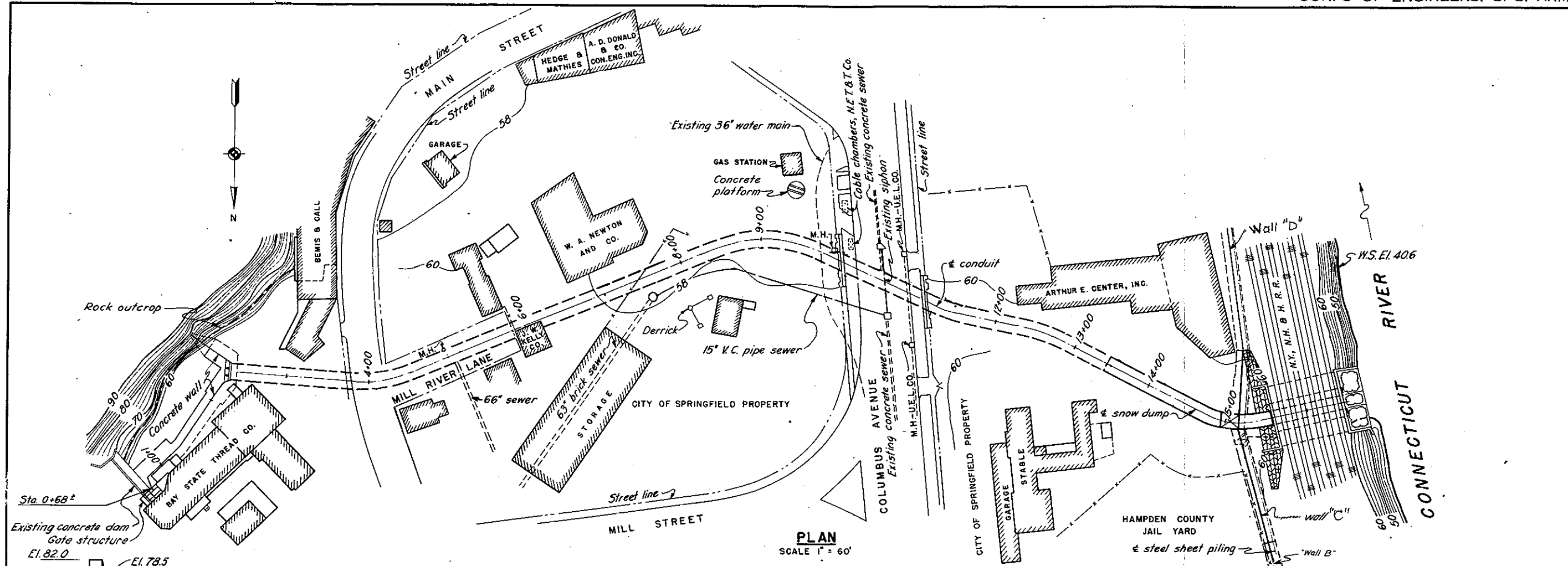
CONNECTICUT RIVER FLOOD CONTROL	
<b>SPRINGFIELD DIKE</b>	
MEMORIAL BRIDGE TO SOUTH END BRIDGE	
GENERAL PLAN AND PROFILE	
WALL "B"	
CONNECTICUT RIVER	MASSACHUSETTS
SCALE 1" = 100' FT.	
U. S. ENGINEER OFFICE, PROVIDENCE, R. I.	
<b>OPERATION AND MAINTENANCE MANUAL</b>	
SPRINGFIELD, MASS.	



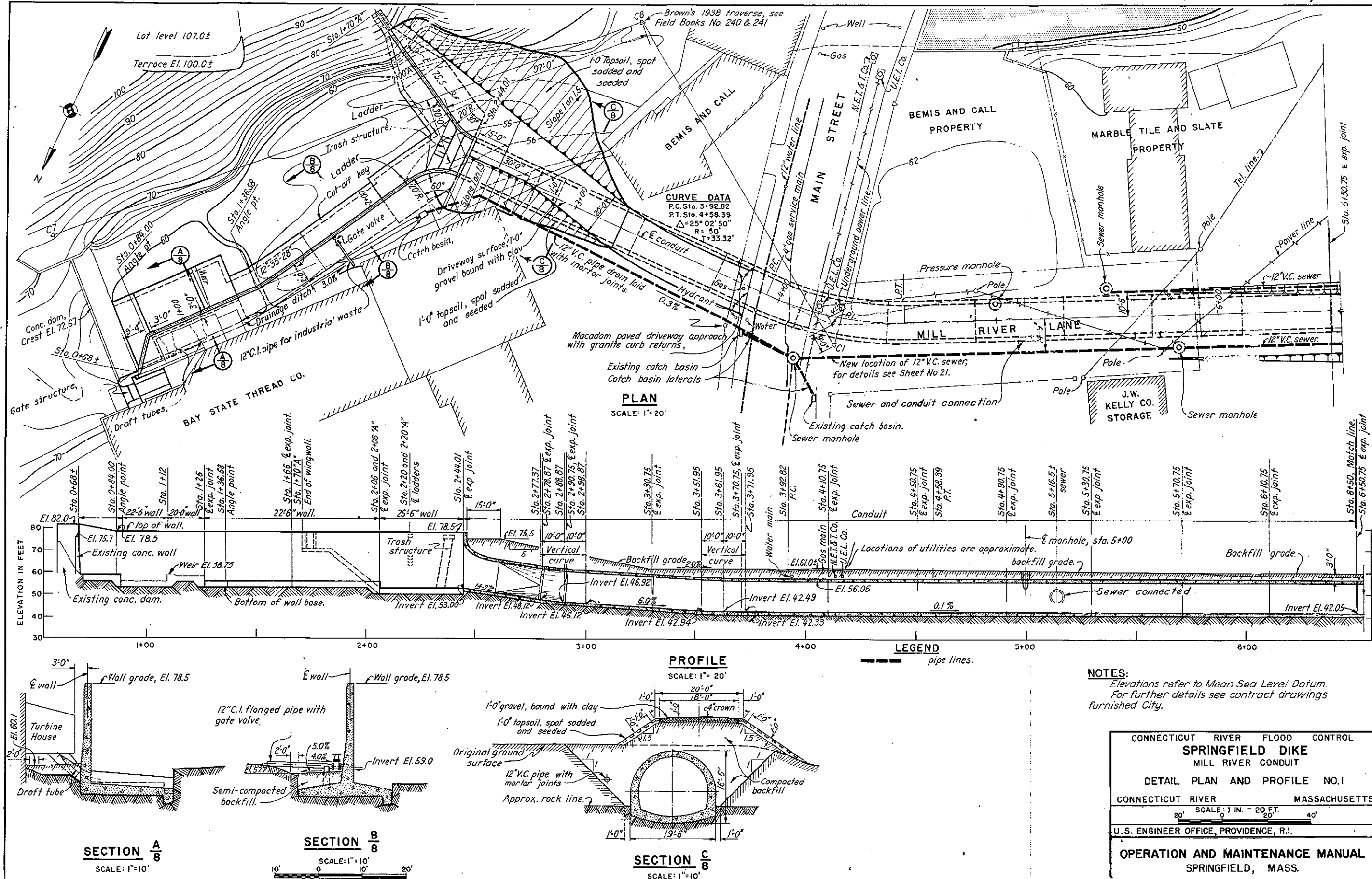


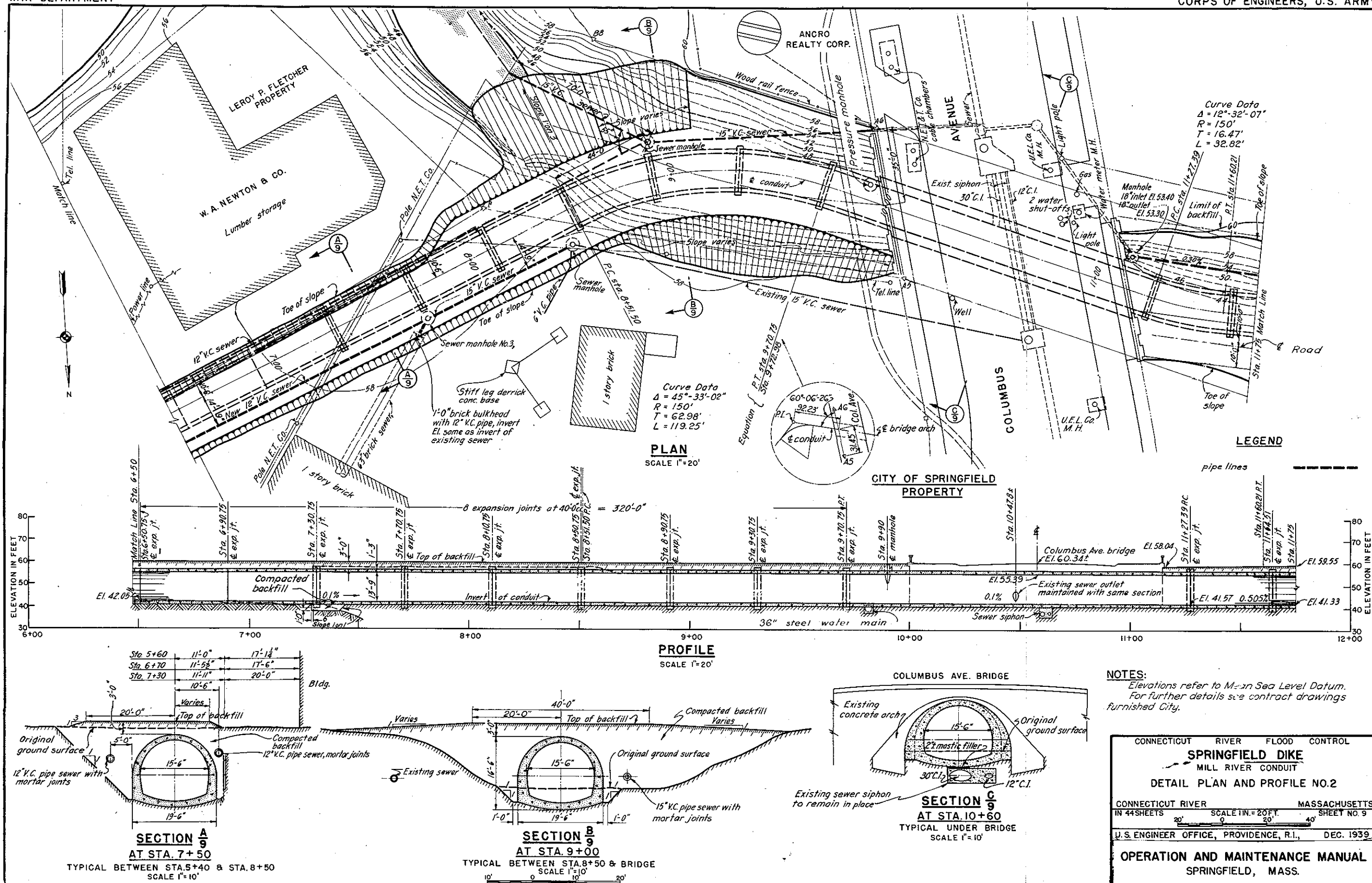


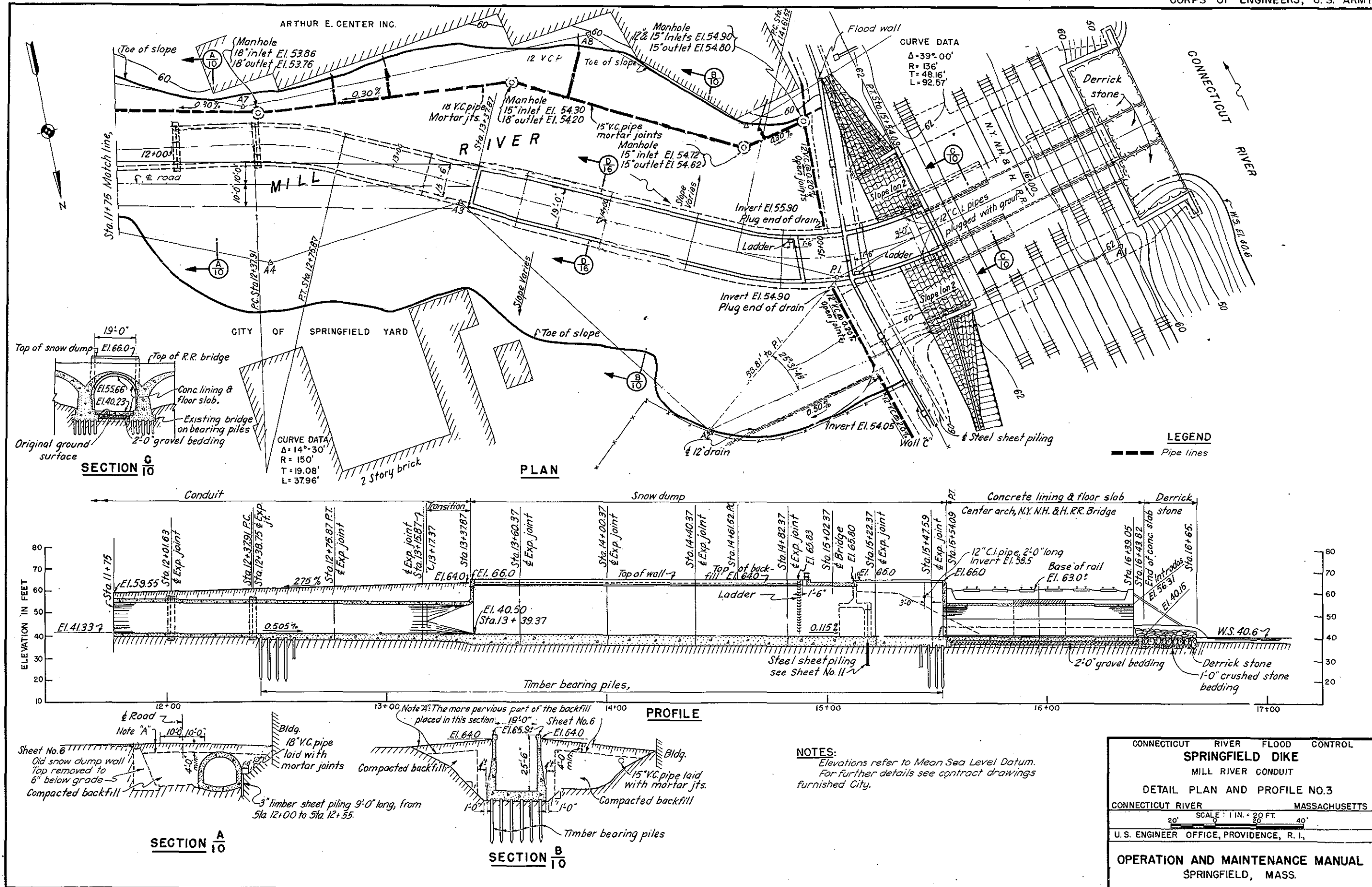


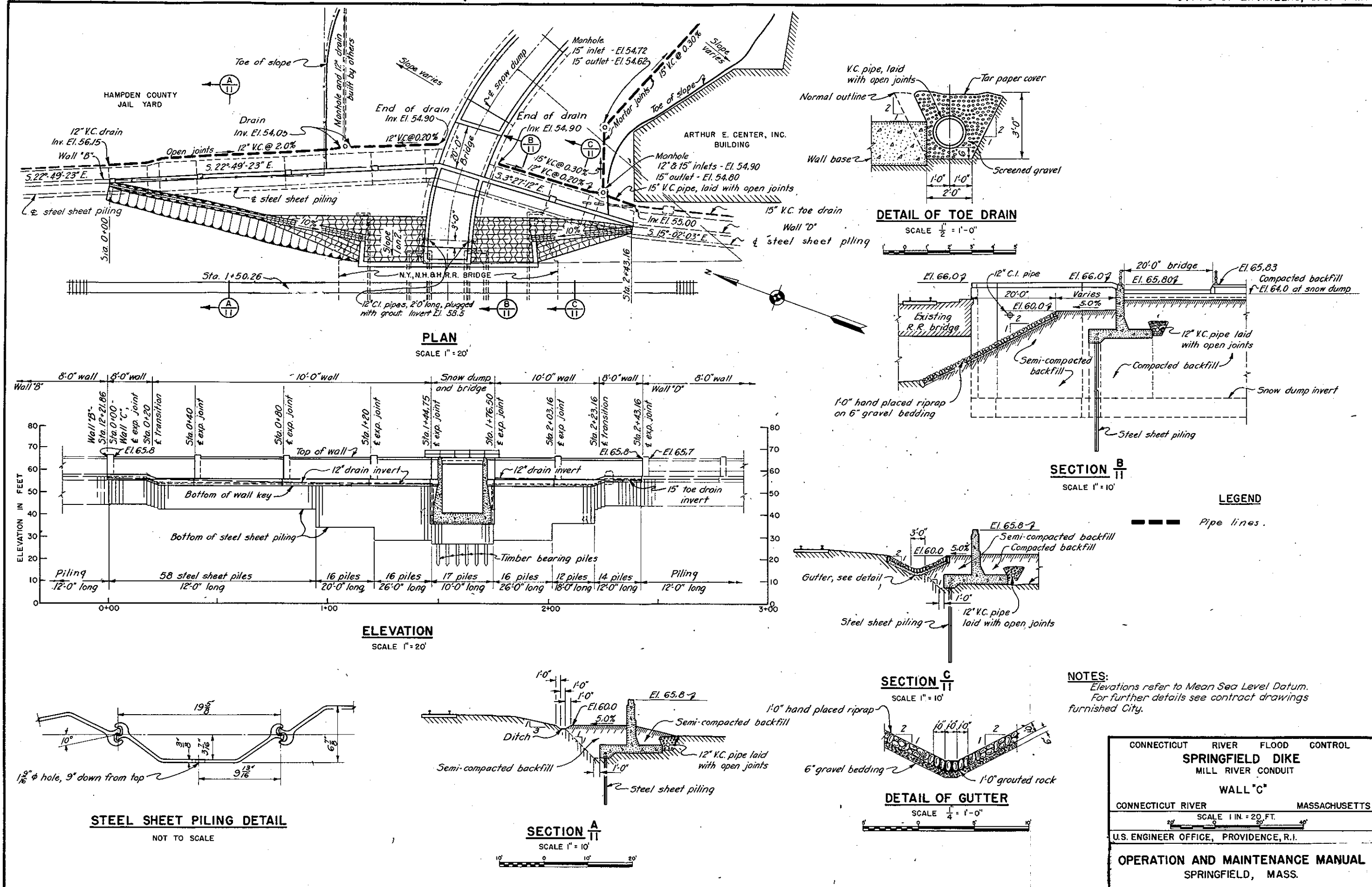


CONNECTICUT RIVER FLOOD CONTROL	
SPRINGFIELD DIKE	
MILL RIVER CONDUIT	
GENERAL PLAN AND PROFILE	
CONNECTICUT RIVER	MASSACHUSETTS
U. S. ENGINEER OFFICE, PROVIDENCE, R. I.,	
OPERATION AND MAINTENANCE MANUAL	
SPRINGFIELD, MASS.	





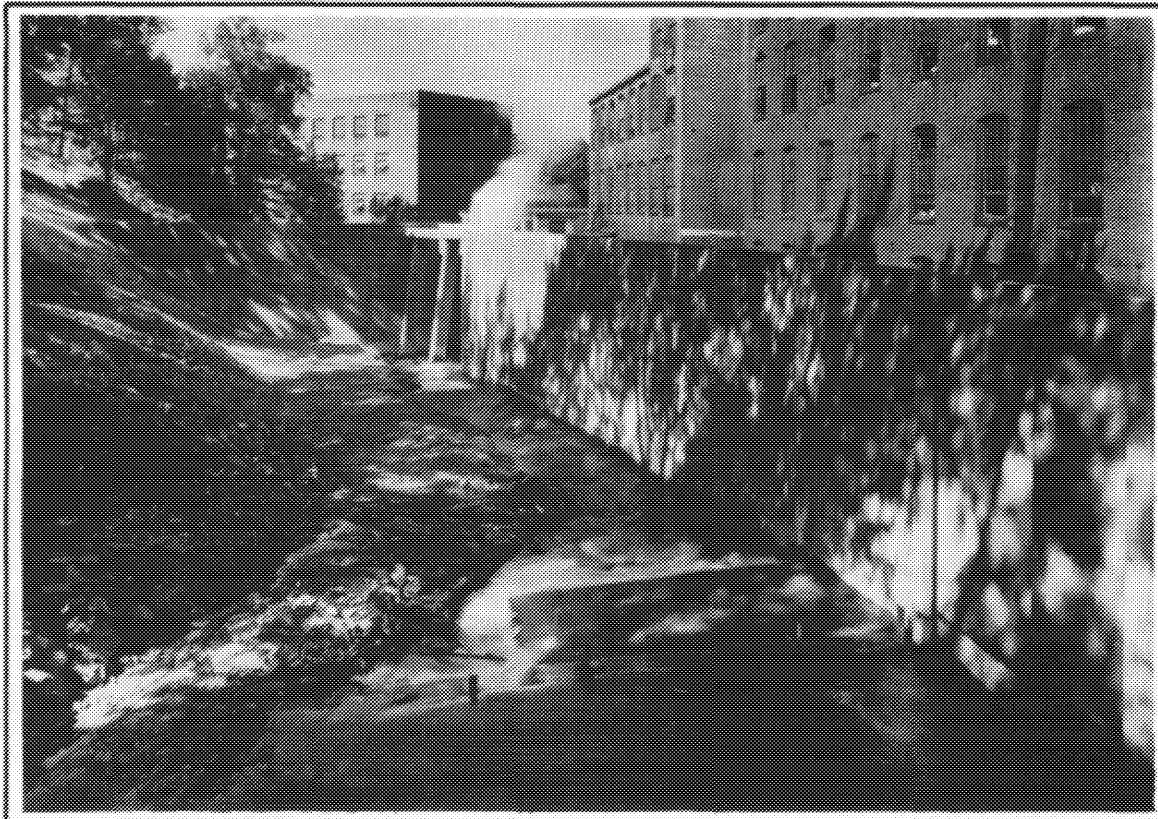




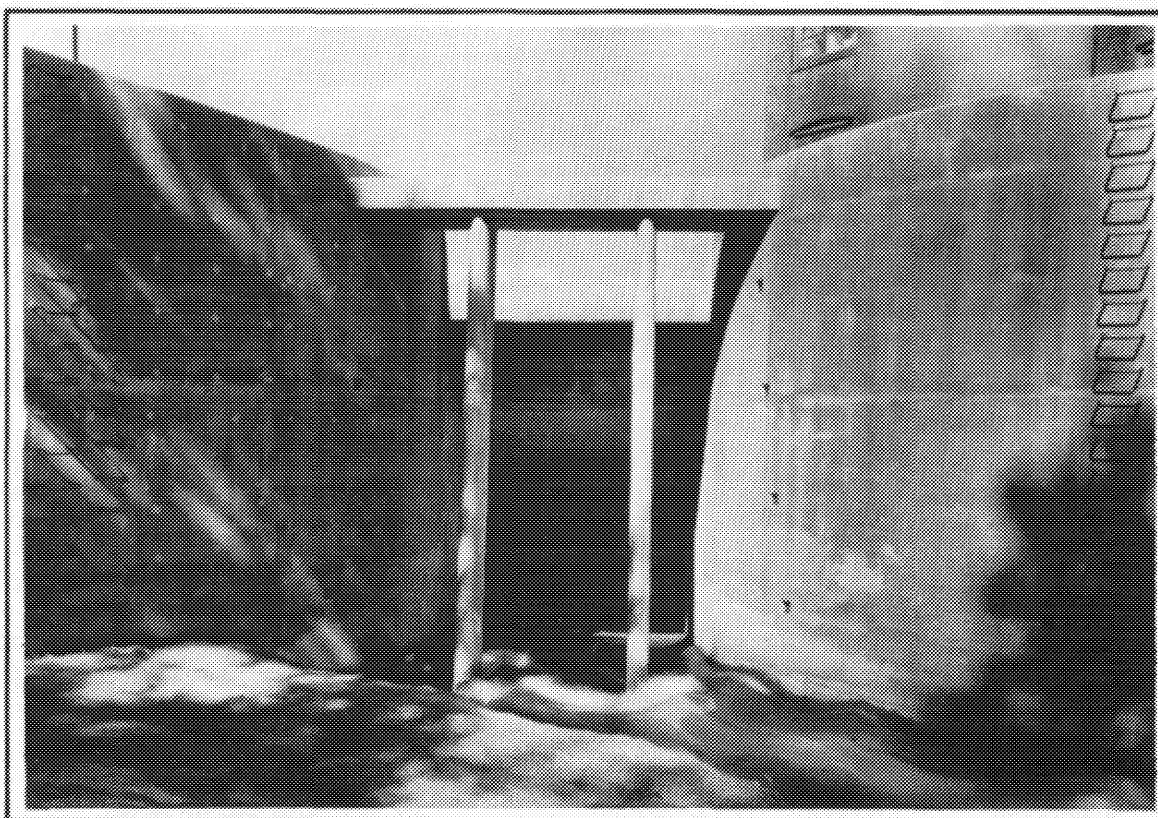
APPENDIX "E"

PHOTOGRAPHS

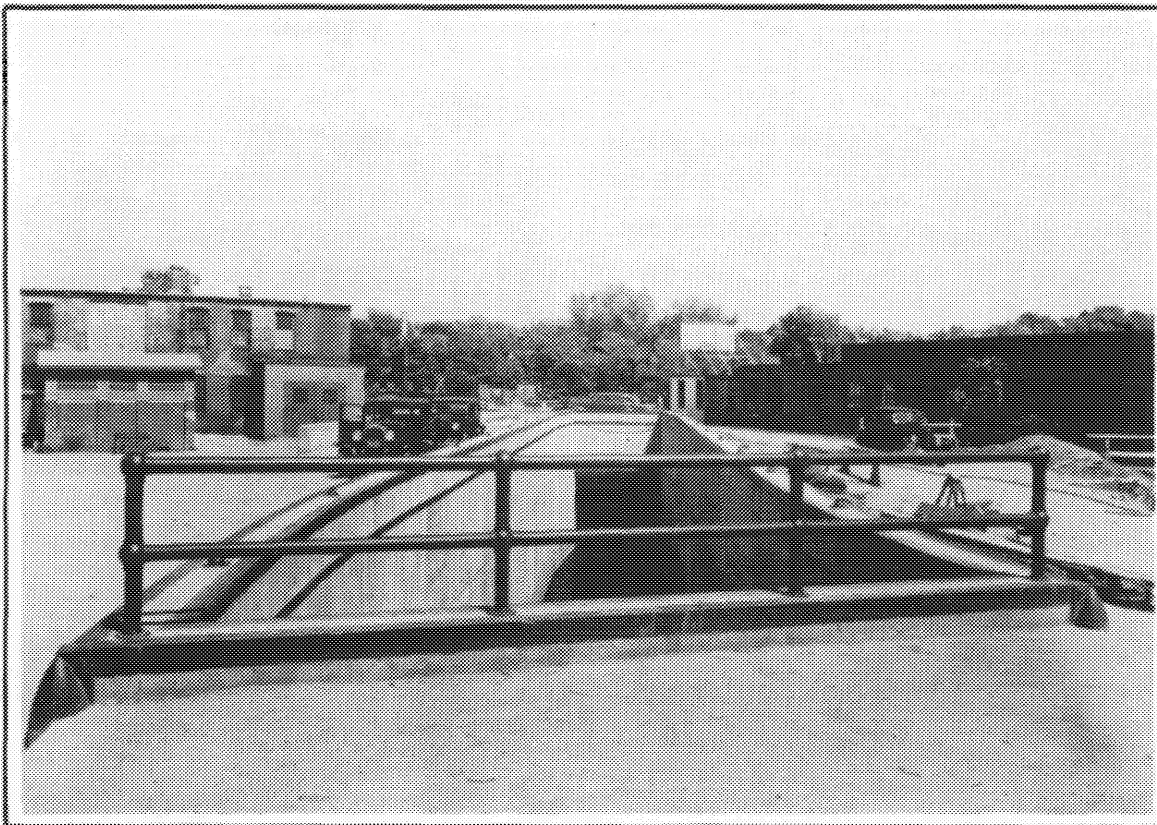




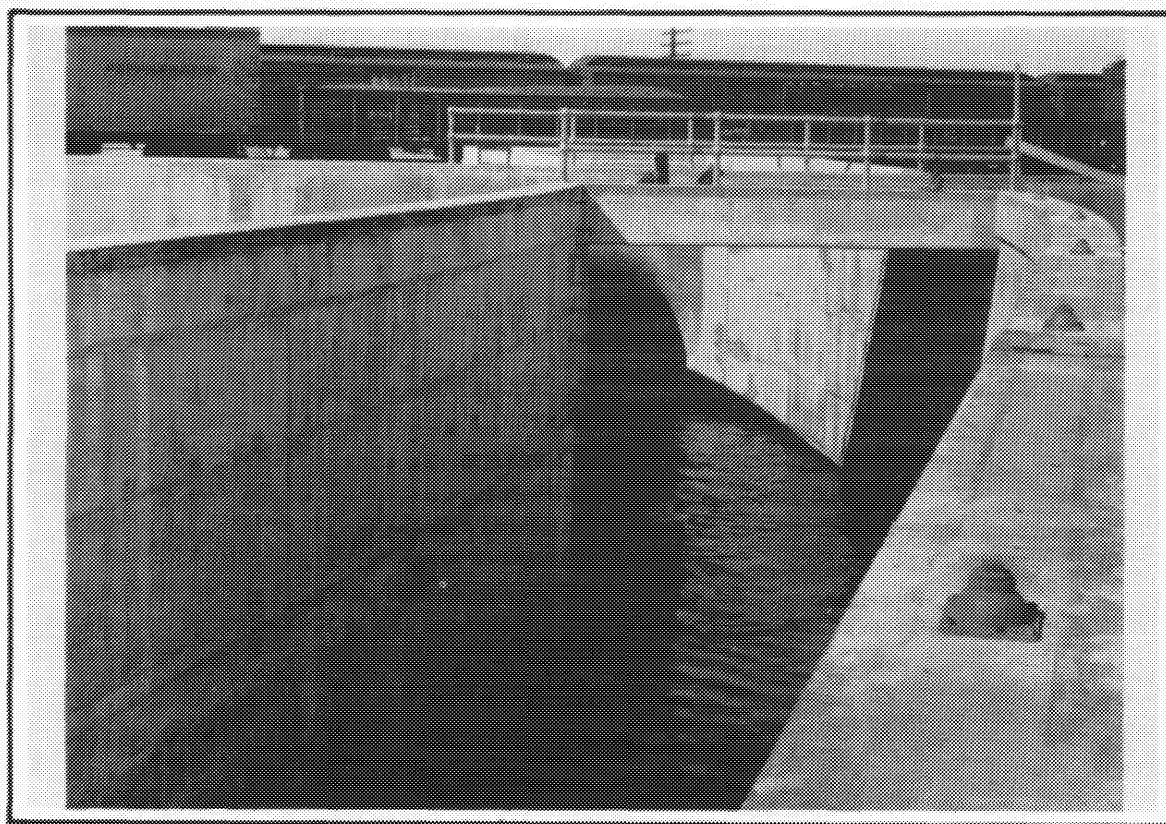
IMPOUNDING BASIN-MILL RIVER CONDUIT



INTAKE STRUCTURE-MILL RIVER CONDUIT

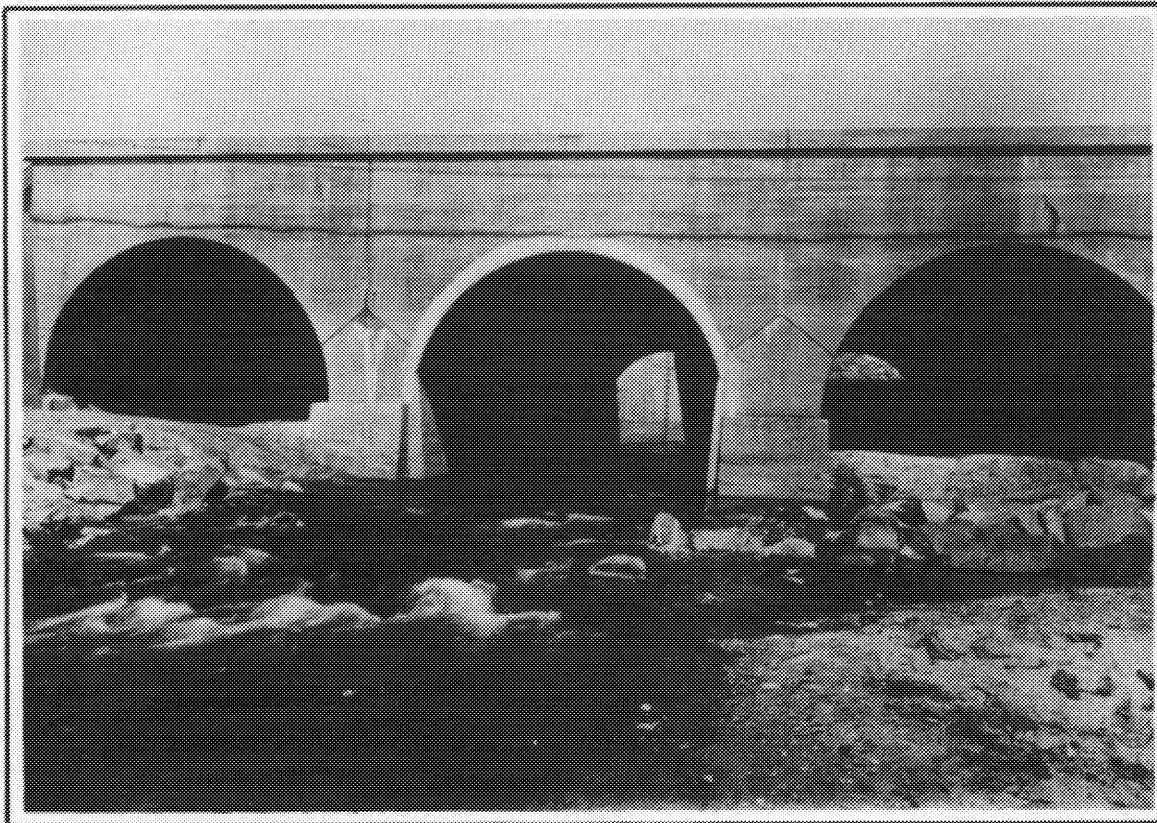


SNOW DUMP - MILL RIVER CONDUIT (LOOKING EAST)



SNOW DUMP - MILL RIVER CONDUIT (LOOKING WEST)

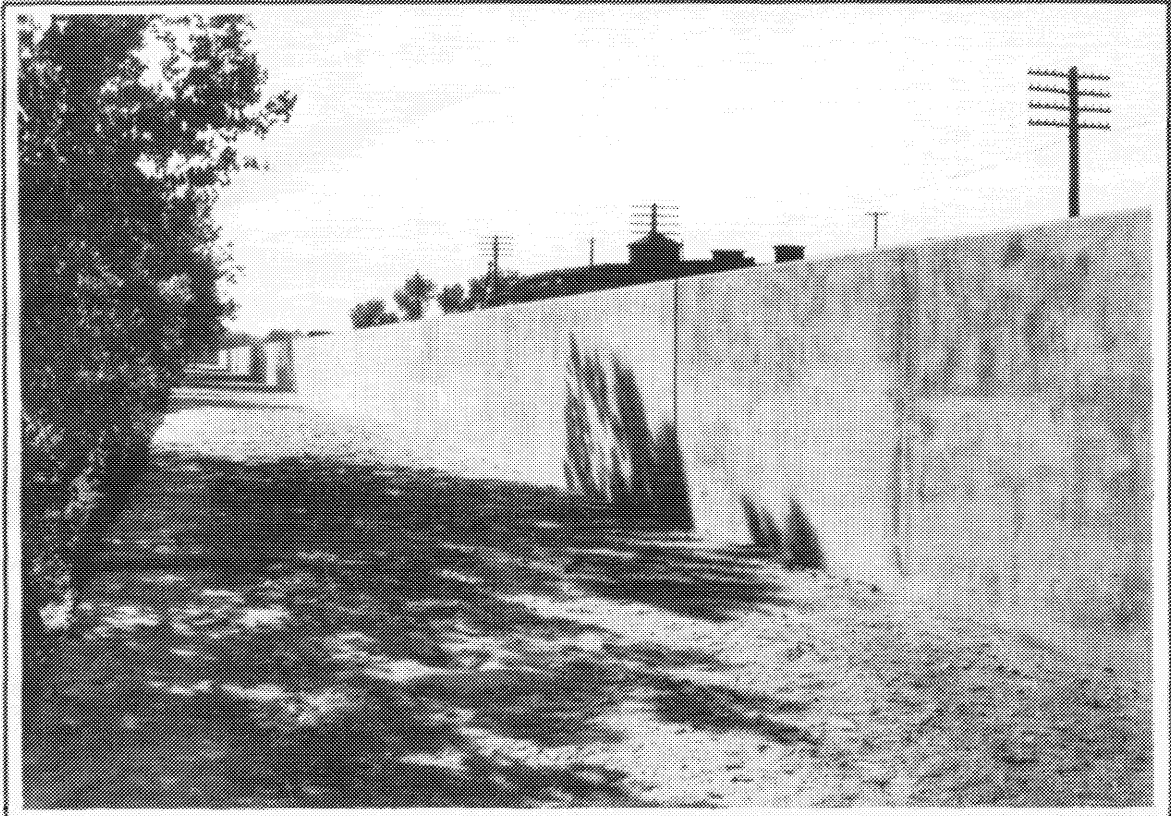




MILL RIVER CONDUIT-OUTLET THROUGH R.R. BRIDGE



DIKE AND RAMP AT SOUTH END OF BRIDGE

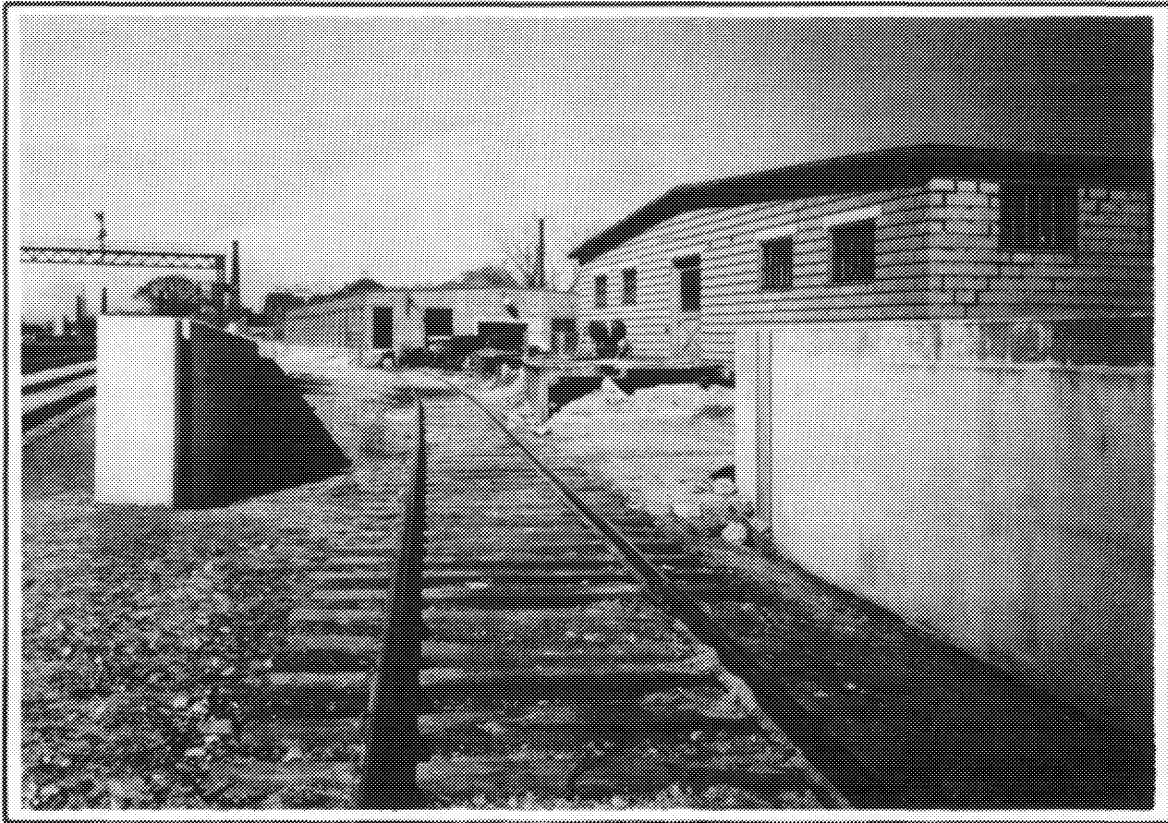


FLOOD WALL BETWEEN CLINTON AND CYPRESS STREETS

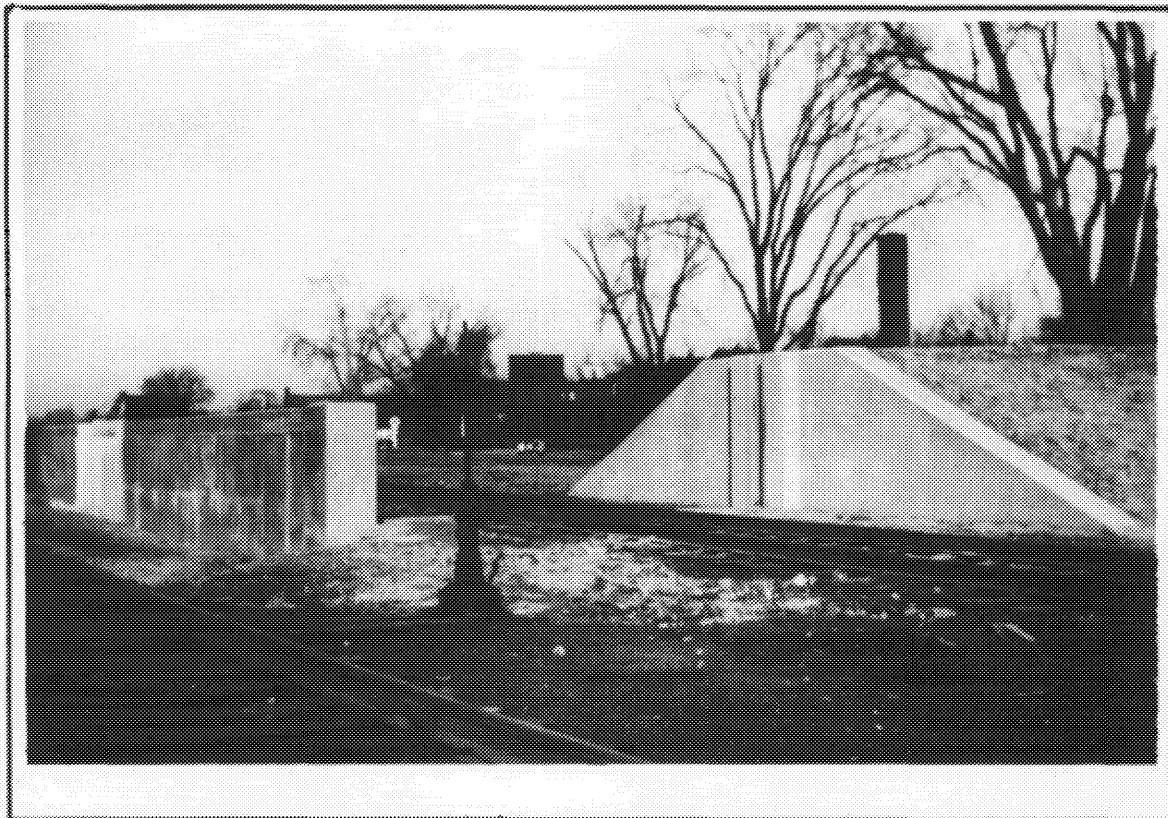


FLOOD WALL ALONG RIVERSIDE ROAD





STOP LOG STRUCTURE NO. 3



STOP LOG STRUCTURE NO. 4